DOCUMENT RESUME

ED 058 998 RC 005 937

TITLE Recreation Symposium Proceedings. The Forest Recreation Symposium (State University of New York College of Forestry, Syracuse, 12-14 October 1971).

INSTITUTION Forest Service (DOA), Upper Darby, Pa. Northeastern Forest Experiment Station.; State Univ. of New York, Syracuse. Coll. of Forestry.

PUB DATE 71

NOTE 217p.

EDRS PRICE MF-$0.65 HC-$9.87

DESCRIPTORS Athletic Activities; Development; Management; Personality Studies; *Planning; *Program Development; *Recreation; Recreational Activities; Recreationists; *Research Needs; Resources; *Symposia

ABSTRACT

In this collection of 26 papers presented at the 1971 Forest Recreation Symposium held at Syracuse, N.Y., information is presented about the forest resource and forest recreation research. The symposium, designed to help meet the needs of the planner and the manager in both public and private areas o f the forest recreation resource, covered 5 general areas: (1) Planning and Developing the Recreation Resource, (2) Managing the Recreation Resource, (3) Characterizing the Recreation User, (4) Specific Managerial Considerations Related to User Characteristics, and (5) A Look at the Research Task Ahead. Among the specific topics covered were the recreation-resource inventory process, predicting values of recreation participation, design of facilities, economics of recreation development and private-recreation enterprises, analysis of environmental-quality ranking systems, multiple use for recreation in the East, law enforcement, and carrying capacity of recreation areas. Included are 337 references. (MJB)

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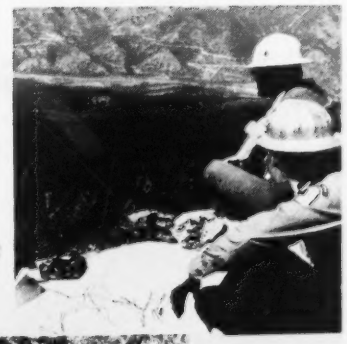
RECREATION SYMPOSIUM PROCEEDINGS

Planned and Presented by:
U.S. Department of Agriculture,
Forest Service and
State University of New York
College of Forestry
in Conjunction with
The Pinchot Institute for
Environmental Forestry Research:
Consortium for Environmental
Forestry Studies



NC UU5937

NORTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE
UPPER DARBY, PA. • 1971
WARREN T. DOOLITTLE, DIRECTOR

THE FOREST RECREATION SYMPOSIUM

Held at State University of New York College of Forestry,
Syracuse, New York
12-14 October 1971

SPONSORED BY—

State University of New York College of Forestry
USDA Forest Service:
  Northeastern Forest Experiment Station
  Northeastern Area State and Private Forestry
National Recreation and Park Association
New York State Office of Parks and Recreation
New York State Department of Environmental Conservation

PLANNED AND ORGANIZED BY—

General chairmen: W. T. Doolittle and R. E. Getty
Program: E. L. Shafer, G. H. Moeller, H. E. Echelberger, D. Morrison, and W. F. LaPage
Local arrangements: A. Hamer and H. E. Echelberger.
Publicity: H. Marx, R. Cochran, and R. F. Johnson
Editor: E. vH. Larson

Northeastern Forest Experiment Station.
1971. **Recreation Symposium Proceedings.** 211 pp. USDA NE. Forest Exp. Sta., Upper Darby, Pa.

A collection of 26 papers presented at the Recreation Symposium held in October 1971 at Syracuse, N.Y., bringing together present knowledge about the forest recreation resource and forest recreation research. The Symposium was designed to help meet the needs of the planner and the manager in both public and private areas of the forest recreation resource.

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FOREWORD

FOREST RECREATION RESOURCE planners and managers are busy people. The surge in demand for recreation in recent years, including all kinds of leisure-time activities, has all but overwhelmed the people who must allocate the necessary funds and resources, design and develop the appropriate equipment and facilities, and maintain and manage the recreation resource. This Symposium was designed to help meet these needs of the planner and manager in both the public and private areas of the forest-recreation community.

Over the last several decades, forest-recreation research results have appeared in all types of publications from one-page how-to-do-it pamphlets to voluminous works on theoretical approaches for an array of recreation-management problems. The decision-maker needs considerable time and money to search through this literature before he finds an answer to his particular problem.

The papers that appear in these Proceedings were prepared in attempts to consolidate and synthesize past research efforts over a wide range of recreation subject-matter areas. At the same time, each paper includes a wealth of reference material that should be helpful to anyone who wishes to pursue a given subject in more depth. But, most important, the authors have written their papers so that planners and managers can understand the important aspects of each subject without having to fight their way through complicated formulas, theoretical concepts, or detailed explanations. Wherever feasible, the authors have simplified the so-called complicated aspects of specific concepts by providing practical examples of how the planning and managing theory works, or does not work, for various levels of recreation activities and resource conditions.

When this Symposium was being developed, almost a year and a half ago, many of the researchers who were asked to participate remarked that if we waited a few more years they would have more research results to reinforce or expand their present data. Such is the lament of every researcher. Forest-recreation planners and managers cannot wait a "few more years"; they want answers now, even though the answers may be subject to a certain degree of error. To paraphrase an old saying, "It is better to have had a few answers to improve the decision-making process than never to have had any answers at all." So we hope that the information presented here, although far from perfect, will result in better forest-recreation decision-making.

And if that is the end result, our ultimate objective for conducting the Symposium will have been accomplished. Furthermore, we hope this Symposium will serve as a catalyst for future summarizations of recreation research results for planning and managing purposes.

—W. T. DOOLITTLE and R. E. GETTY

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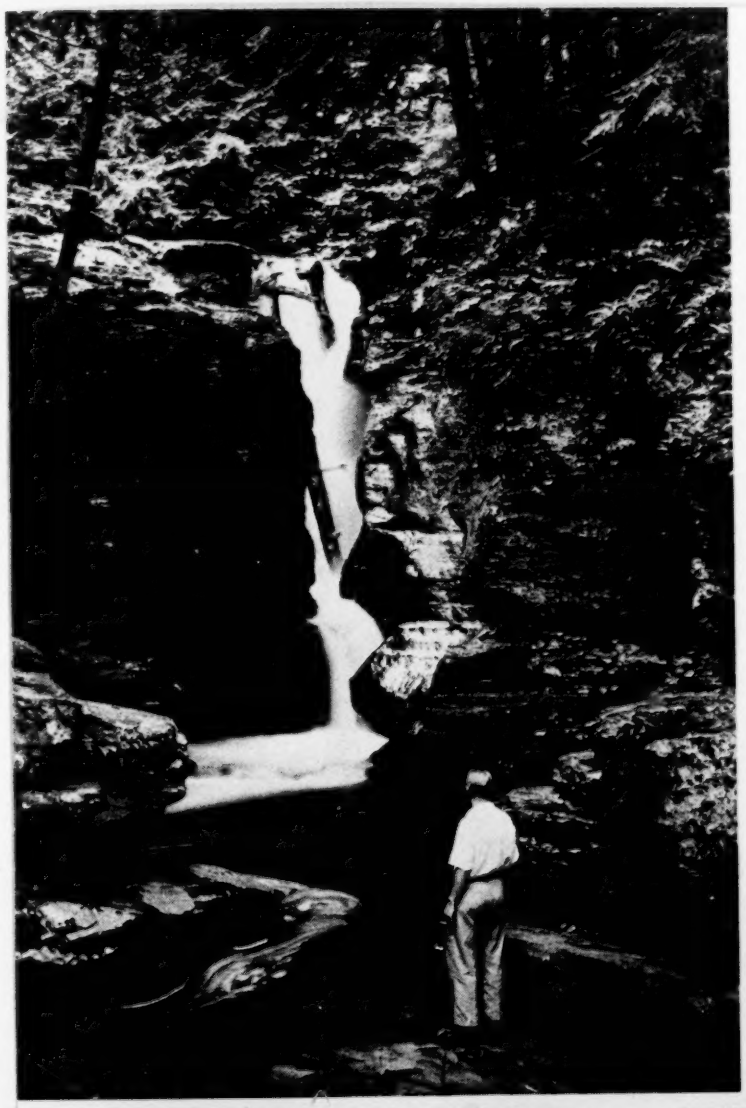


Planning & Developing the Recreation Resource

THE RECREATION-RESOURCE INVENTORY PROCESS FOR STATE AND REGIONAL PLANS

by HUGH C. DAVIS, *Associate Professor of Resource Planning, Department of Landscape Architecture, University of Massachusetts, Amherst, Mass.*

ABSTRACT. The establishment of guidelines for identifying recreation resources in the inventorying process should be limited to conditions and characteristics of the natural resources themselves. This requires not only that we define recreation, but also that we prescribe the combination of resources necessary to carry on a variety of recreational activities.

THIS PAPER deals with concepts rather than techniques. The traditional approach to the topic is *how* to make an inventory of recreation resources. This has been discussed in several government publications and new approaches have been reported in a variety of professional journals. Rather than summarize what we now know about inventorying recreation resources, I have chosen to explore several relevant topics that we do not know so much about, and to suggest a few areas that need study.

Perhaps the greatest problem in making an inventory arises from the physical requirements for outdoor recreation activities. Collectively these are so broad as to be almost without bounds. Compare, for example, the task of identifying potential new dam sites in the Northeastern United States with the task of identifying potential new campgrounds. Realistic minimum physical requirements for dam sites can be easily established. Air photos and topo maps can be studied and tentative locations can be placed on maps. A great quantity of necessary backup geological and hydrological data are already available, and these can be collated with the specific sites identified. Coupled with on-site investigations, a strong economic, social, and physical case can be presented for the desirability of one site over another.

But what are the realistic minimum requirements for a public campground? Certainly by now we have all developed some sort of administrative and managerial "standards." But the real pertinent question is: Are these minimum requirements based on physical resource requirements necessary for camping?; or are they more-or-less arbitrary factors based on agency philosophy and personal values? Clearly the latter is most often the case. This is so because one can, from the resource-requirement point of view, "camp" almost anywhere. Unlike a dam site, natural-resource constraints on camping are few indeed.

A BASIC PROBLEM

Herein lies a basic problem in making an inventory of potential recreation resources. For we cannot in fact make an inventory without at one and the same time evaluating. Regardless of the techniques adopted

to locate new areas for recreation activities, we must first establish some guidelines that permit a rational and more-or-less consistent means of selecting one area and rejecting another.

We generally refer to such guidelines as "standards," and they are in fact a partial evaluation process, because they dictate that a particular combination of natural resources is suitable for a camping area while another set is not. In almost all cases, however, these standards are not based exclusively on resources capabilities, but rather are a combination of economic, social, and administrative factors coupled with resource characteristics.

To express this same point in another way: the identification of new areas for potential state parks will set some minimum total size, say 600 acres. This is largely an economic and administrative standard apart from the natural-resource capability, and it reflects the cost and management difficulties encountered in running a multitude of 50- or 100-acre parks scattered throughout a state. Social and political constraints are reflected in these standards by attention paid to the distance from centers of population and proximity to other already existing recreation areas.

All this is by way of saying that the broad basic guidelines used for identifying and making an inventory of recreation resources are not founded strictly on the characteristics of the resources themselves, but rather on a mixture of several kinds of constraints. Though it is clear why this is done, there are benefits to be derived if this were not always the case.

Consider the situation of a state beginning an inventory as a necessary early step in the revision of its state-wide recreation plan. Previous so called "demand" studies indicate a need for additional campground. We know that recreators do not just go camping, but that they engage in other recreational activities, and that the tent or trailer is often just home base. Thus the new campgrounds should be near water, and in association with woodland or forest for hiking and so on. We also know that certain parts of the state are currently better serviced with recreation areas than other sections. Money for campground development is limited, and the dollar must be stretched. And finally we are well aware that funding agencies in Washington are more receptive to the creation of new areas close to urban centers.

THE SHORTCOMING

All these considerations and many others will be given attention in preparing the specifications or guidelines to assist in identifying potential campgrounds. The more specific the standards can be made, the easier and more efficient will be the job of identifying all areas meeting the criteria.

The inventory is then made, using whatever techniques are most appropriate. Assuming it has been done properly, when the inventory is completed, *all* areas meeting *all* the established standards will have been located and recorded. And perhaps more important, *all* areas that do not meet *all* standards will *not* be recorded.

In this greatly oversimplified example, what has actually happened? What is the difficulty with this rather standard approach? I suggest that too much of the total planning process has been made an integral part of what really should be only a data-gathering process. Too many planning considerations have been built into the "selection" process of identifying recreation resources. For, in fact, a vast number of resource complexes suitable for camping have not been identified because they lacked the non-resource characteristics that were built into the standards. In reality what happens in these situations is that, in terms of the recreation resource, a kind of development priority system became a major and inseparable part of the inventory process.

I believe this is undesirable for several reasons. First, it is not a complete inventory of areas physically suited for campgrounds. Second, and closely tied to the first, it greatly reduces the planners' ability to consider alternative development programs. Third, and by far the most important, while natural-resource complexes do change over time, they change at a much slower rate than do political, economic, social, and administrative condi-

tions. Thus, when any or all of these latter constraints change, the inventory will have to be repeated in light of the new situation and its effect on the standards and guidelines.

Finally, by placing so many different kinds of constraints on the data-gathering operation, economic and decision-making efficiency is increased but at the expense of planning flexibility. And an inflexible plan is almost always an extremely poor plan.

THE ALTERNATIVE

The alternative to this, it seems to me, is quite clear. The establishment of guidelines for the identification of recreation resources in the inventory process should be limited to conditions and characteristics of the natural resources themselves. This, as most of us know, is not as easy as it sounds. It not only requires that we define recreation (no small task in itself), but also that we prescribe the combination of resources necessary to carry on a variety of activities. It may perhaps be helpful to explore this task a bit further, and to consider some of the things involved.

First, as part of the definition process, a list of basic outdoor activities must be compiled. This list itself is a kind of definition in that what it includes is considered outdoor recreation and what is left out is not. The list is of prime importance, as only data pertinent to it will become part of the inventory; thus the list forms the limits of recreation content of a subsequent plan. It is my belief that initially this list should attempt to be all-inclusive and cover as complete an array as possible of those recreation activities that are dependent upon an identifiable nature resource base.

This activity list, I believe, is so important that if it is the responsibility of a public agency to make an inventory, that agency should involve citizen advisory groups in the task of its compilation to assure as many different kinds of activities as possible.

The second part of the task centers around the fact mentioned earlier: that there are certain kinds of outdoor recreation activities that are non-specific in their resource requirements. This of course means that some specifications for identification must be established. The development of these specifications is extremely significant, for they in fact begin to attach a *quality* to the recreation experience.

Using again the simple example of a potential campground, if the identifying guidelines include such things as size of potential areas, presence of flat water, and percent of tree canopy cover, some degree of a quality environment for the camping experience is being established. Obviously additional increments of quality may be added or subtracted through area design and management techniques. But nevertheless the basic resource combinations looked for in the inventory are, or can be, a first stage in some sort of quality measurement for recreation experiences.

This concept is useful in another way as well. If the guidelines for identifying recreation resources include these sorts of things, as determinants of a "good or bad" environment for the list of activities, I suggest they may also be useful as one component in the actual planning task of establishing a series of priorities for development.

This is not contradictory to what I have suggested above, for it is only *one* of many factors in the planning process that must enter into a priority schedule. It is strictly limited to the character of the resource. It offers no assistance in regard to political, economic, social, and administrative priority considerations, which are, and should be kept, separate from natural resource capabilities.

IMPLICATIONS

This rather brief description of the identification and inventoring of recreation resources suggests several things. First, that the process be limited to natural resources. Second, that an activity list be developed that suggests the kinds of recreation one is seeking to provide. Third, that guidelines must be established that define the necessary characteristics of the resources needed to provide the recreation activity. Fourth, that the previous three steps can provide data that are useful in the planning job for

suggesting a set of alternative development priorities. Finally, it implies that additional information must be collected relating to other factors that enter in the recreation planning procedures. This material can perhaps be gathered at the same time as the resource data, but it should be a totally separate and distinct tabulation. Only *after* the inventory is made are these various sets of material combined and final plans established.

It is clear that in the identification of recreation resources the most critical element is to establish the guidelines or standards. Research in this area continues to be important. The studies on this broad topic have made some headway. But more studies of user responses to various resource conditions will be most helpful. For example, how do people react to different sizes of beaches? Does length of stay on a beach change as density of users changes. Is there a preference for campgrounds etc. in coniferous stands over hardwood areas? What sorts of recreation can be combined in one area without diminishing the quality of a user's experience? How do these activity combinations shift, if at all, as resource characteristics change?

Finally I suggest that perhaps the single most important study needed, and one of the most difficult, is of how people perceive their environment. Were we to have this information at hand, it might well change many of the arbitrary standards we are forced to use at present.

■

PREDICTING QUANTITATIVE AND QUALITATIVE VALUES OF RECREATION PARTICIPATION

by ELWOOD L. SHAFER, JR., *and* GEORGE MOELLER, *respectively Director, Pinchot Institute, Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Upper Darby, Pa.; and Project Leader, Recreation Research, Northeastern Forest Experiment Station, Syracuse, N. Y.*

ABSTRACT. If future recreation consumption and associated intangible values can be predicted, the problem of rapid decision-making in recreation-resource management can be reduced, and the problems of implementing those decisions can be anticipated. Management and research responsibilities for meeting recreation demand are discussed, and proved methods for forecasting recreation use and associated qualitative values are presented. The best approach for developing recreation-participation rate equations may be to include a distance factor, recreation-supply variables, socio-economic measurements of users and non-users, and qualitative measures of recreation environments – all in the same model. The effects of technological progress on values and behavior patterns are described; and methods for forecasting relevant technological advances are outlined.

AMERICANS, with more time on their hands and more money to spend than ever before, boomed leisure into an 83-billion-dollar business in 1969. *(U. S. News and World Report 1969).* That figure tops the total outlay for national defense during the same year. The money going into outdoor recreation activities and equipment reaches into almost every aspect of the Nation's economy. Today, pleasure *is* business. And it's the fastest-growing business in the land.

Behind the scenes, serving the ever-increasing demand for the trappings of leisure, are the muscle and sinew of American technology. But the responsibilities of meeting the quantitative and qualitative aspects of outdoor recreation demand for forests, mountains, lakes, and streams on public and private lands rests squarely on the shoulders of recreation resource planners and managers.

This paper deals with the problems of forecasting the quantitative and qualitative aspects of outdoor recreation participation. At times this objective seems almost insolvable, for this is a dangerous corner in the research arena where natural sciences and social philosophies collide with a resounding crash.

In America, the dominant school of thought in resource management has been preoccupied with the *quantity* of things—volume of output, reduction of costs, creation of plenty. This is the trademark of our industrial-technological system: the ability to produce large quantities for large numbers of consumers. But the pendulum

is swinging back. Today, many foresters are deeply concerned with matters of *quality* – especially quality of forest environments as they relate to the leisure-time enjoyment of our society.

However, it is one thing to point out the need for forest-recreation resource planning and management to include both the tangible and intangible values of outdoor recreation. It is quite another thing to make profound institutional changes that pervade all society, in order to carry through such recommendations. It's still another thing–the most difficult of all–to make those changes *fast*.

Institutional changes and related changes in political and social values become even more important if resource managers try to meet recreation demand *over the next decade*. This means that institutional changes must happen rapidly if they are to be effective during the next decade, and they will have to occur pervasively.

In many cases, forecasts of quantitative and qualitative aspects of recreation use will need to be conducted quickly, before managers have the knowledge needed to act. Otherwise predicting recreation consumption and relating it to supply will continue to be what Chubb *(1967)* called "the Achilles heel" of recreation planners and managers. Thus there is an urgent need to analyze the problems of forecasting quantitative and qualitative values of forest-recreation participation, and to recommend the necessary research studies and costs required to solve those problems.

The major reasons for forecasting the quantitative and qualitative values of outdoor-recreation consumption are:

- To recognize possible implications of long-term recreation-management commitments made today.
- To prepare now for related commitments that will have to be made rapidly, economically, and with minimum disruption sometime in the future *(Warren 1966)*.

If future recreation consumption can be predicted, the problem of rapid decision-making can be reduced, and the problems of implementing those decisions can be anticipated.

PRELIMINARY CONSIDERATIONS

Management Responsibilities

Recreation-resource managers are almost certain to face disaster as a profession if they do not plan for quantitative and qualitative recreation values of outdoor recreation in carrying out their management responsibilities. On the other hand, managers are most certain to increase the likelihood of having a more respected profession if they plan for these values. Even if managers increase their understanding of the recreation - consumption phenomena, they are likely to face deep trouble because even the best plans will be developed and fostered by people with limited knowledge, sometimes unaware of the extent of their own limitations.

To better understand the relationships among recreation-consumption patterns, recreation-supply variables, user characteristics, management procedures, technological advances, and intangible recreation values, recreation-resource managers and researchers must be willing to change some of their present attitudes and research approaches.

The resource manager will have to accept and use research results or models that involve many variables. These variables will be related probabilistically and will describe cause-and-effect demand-relationships over long time periods (5 to 10 years). In some circles, this suggestion may be a difficult pill for managers (and researchers) to swallow. It is not unfair to say that a minority of managers will absolutely refuse to accept this premise; consequently, some future research will be designed according to the way these same managers perceive the problem of forecasting recreation values. Such research will undoubtedly produce nothing more than sugar pills to cope with the problems of forecasting recreation values.

In recent years some managers have remarked, "Give me a method for forecasting recreation consumption that's fast, inexpensive, easy to apply, and easy to understand." Given adequate funding, research can provide management with equations, or formulas, or models that predict tangible

and intangible values of recreation participation. These models can be quick, easy, and inexpensive to use. However, there is no guarantee that management or researchers will fully understand why these equations work. Herein lies one of the most difficult problems in the use of formulas for forecasting recreation demand and intangible values—accepting prediction procedures that are not fully understood.

With the responsibility for making recreation-management decisions that involve thousands, and sometimes millions of dollars, recreation-resource decision-makers usually want answers—not estimates—about recreation consumption. To be sure, these same decision-makers recognize that recreation-consumption forecasts are statistical estimates that sometimes may be nothing more than carefully formulated guesses. At the same time, managers may rebel at the idea of receiving these guesses in a form that emphasizes uncertainty. For example, a researcher may publish the statement: "On the average, a certain recreation activity will increase by X percent by the year Y, with 95 percent probability". There does not seem to be any easy way to work around the problem of uncertainty or probability, or to directly relate the "average" results of a recreation-user survey to a particular recreation-management situation that usually is not "average".

If this problem of uncertainty and variability is to be met, it must be met head-on. One way of doing this is to develop forecasts in light of what may be expected under best, worst, and most likely future recreation-behavior and supply conditions. Forecasts from such an approach reflect the impossibility of precise prediction, and should logically lead to the development of management plans designed to cope with *alternative* future conditions *(Warren 1966)*.

Research Responsibilities

Many of today's recreation researchers need to reorient their thinking in forecasting recreation demand and in measuring associated intangible values. Researchers must realize that to apply common sense to what is visible on the surface concerning man's social enjoyment of the forest may not always be correct, and may lead to about as good an idea of true causes and effects as that afforded by the Ptolemaic system that proclaimed that the universe rotated around the earth. A true grasp of even the simplest interaction of man and nature requires special knowledge and the ability to use abstractions, which like the Copernican system is at odds with commonsense impressions as one gazes at the universe on a starry night.

Today's recreation-resource planners and managers do not have the time or inclination to delve into the many details of forecasting quantitative and qualitative values of recreation use. Therefore the researcher's responsibility is to eventually produce results that are meaningful to the recreation-management process.

At the same time, researchers need to help recreation-resource managers emerge from a stage of conventional wisdom to a state where managers understand *how* recreation consumption will occur. For instance, if researchers do not explain the process by which recreation consumption occurs, such an explanation is as meaningful to management as the Apparition's proclamation in Shakespeare, that Macbeth would "never be vanquished until Great Birnam wood" came to "Dunsinane Hill", or that Macbeth would not be harmed "by man born of woman" *(Clark 1936)*. Unfortunately Macbeth never heard of camouflage or cesarean birth.

Similarly, recreation researchers should not be content to proclaim, for example, that, as family income drops, recreation consumption also drops. A decrease in income could be caused by reduction in the work force (which may have a negative effect on recreation consumption); or a decrease in income could be caused by workers taking longer vacation periods (which may very likely have a positive effect on recreation consumption). Methods developed to forecast recreation consumption are most likely to be accepted if research shows management *how* recreation consumption takes place, rather than just provide management with an equation that forecasts consumption based on past or present data.

Furthermore, sufficient time should be

available in the research schedule to allow for updating research communications between management and research. This can be accomplished once or twice a year by researchers and interested recreation resource managers hibernating in some secluded spot and asking each other such unaskable questions and rethinking such overall problems as: Are we really conducting relevant research in this area? For whom? What changes are needed to more effectively provide the necessary demand models? What are managers going to do with the research results when they have them? Why do we want to know the answer to that question regarding intangible values? If I could give you the answer to that question right now, how would it change management operations? Are we really asking the right questions? In what form would research results be most useful? Are there better ways to get the answers you want? Are you willing to pay the cost required to obtain the information?

These kinds of discussions will be hard work, but more needed research changes and reorientation of key problems will come out of such meetings than out of a group of year-round recreation researchers working behind closed doors.

Prediction Model Characteristics

Forecasting was once an honorable occupation for seers and magicians. Over the last 10 to 20 years science has attempted to take forecasting of recreation-use and intangible values out of the area of conjecture, and to develop equations that make accurate prediction possible *(Duhl 1967)*. In fact, equations for predicting certain types of recreation values have already been developed for specific management purposes. In most cases, research is needed to improve the reliability of these equations, but the toughest part of the problem—methodology—has already been solved. Surprisingly, very few managers have adopted these methodologies to their particular recreation-management problems. Why? For some of the reasons already discussed under the professional responsibilities of management and research. Therefore, before reviewing various equations that predict quantitative and qualitative values of outdoor recreation, we must discuss certain general features of these equations (or models).

The equation to determine the area of a circle is

$$A = \pi R^2 \qquad (1)$$

To find A, one simply measures the radius of any given circle, squares it, and multiplies it by the constant π.

Here is another equation:

$$U = 3409 - 0.0183\ X_1 + 0.1757\ X_2\ (X_3 \bullet X_2^2) \qquad (2)$$

which is as simple to use as $A = \pi R^2$, except that it forecasts quite accurately the average annual use intensity (U) a manager can expect at any given campground in the Adirondacks *(Shafer and Thompson 1968)*. The numbers in the equation, such as 3409 or 0.0183, are constants, just like π in the first equation. Except now, instead of measuring the radius of any circle to find its area, one measures the items (or variables) designated as X_1, X_2, and X_3 for any given or planned campground:

- X_1 is the total square feet of land and water area at the campground's swimming beach.
- X_2 is the total number of campsites in the campground.
- X_3 is the total number of islands accessible by motorboat from the campground.

Insert these three values in the equation, perform the necessary calculations, and you can determine the total average annual visitor-days that can be expected at a particular Adirondack campground. The time required to measure the three X values from topography maps, or site-design layouts, is approximately 5 minutes.

Predictive recreation-consumption formulas have also been developed that involve other kinds of variables (X values). However, the overall approach to forecasting tangible, and even intangible, values of outdoor recreation is the same. The major problem is to define the variables that you think are important in influencing demand, and then to mathematically find the relationship between those variables and some

measure of behavior, or attitude, or participation in a given recreation activity.

But how does one decide what equation or methodology to use when forecasting recreation values? If a recreation-resource manager adapts results of previous research to solve his particular forecasting problem, such research should be closely related to the scope of the problem at hand; otherwise, a new forecasting equation should be developed through additional research.

In evaluating an equation that forecasts recreation participation or amenity values, an important consideration is the R^2—multiple correlation coefficient squared. An R^2 value, which can vary from 0 to 1, describes what percent of variation for the value being predicted is explained by the equation. The closer R^2 comes to 1, the better the equation. Based on past research efforts, one way to evaluate how useful an equation may be for forecasting recreation use or amenity values is as follows:

If the R^2 value of an equation is ——	*Usefulness of the equation for management purposes* — —
0 - 0.20	Poor
0.21 - .40	So-so
.41 - .60	Pretty good
.61 - .80	Very good
.81 - 1.00	Really great

Now we will examine how the R^2 value of various predictive equations found in past research change according to the types of variables used, and the area or size of the recreation attraction involved. Results of this literature review will help to justify the selection of future research studies, and to pinpoint the variables that should be studied when forecasting future recreation values.

EFFECTS OF QUANTITATIVE VALUES ON PARTICIPATION

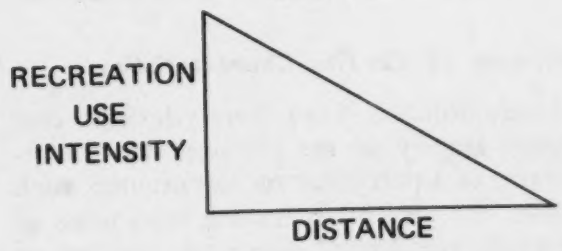
Economic Demand and Distance Measurements

Attempts to use economic-demand curves for assigning monetary values to recreation benefits are in response to a need felt by administrators who want to justify recreation-facility developments. At the same time, considerable opposition to the economic approach has arisen. Wilderness users, sportsmen, welfare workers, and others have argued that intangible recreation benefits cannot be valued quantitatively, and that any attempt to do so misses the qualitative essence of such experiences.

Economic-demand curves for recreation participation *do not* measure the diminishing marginal utility of recreation facilities. Statistical economic-demand curves are simply a convenient way of summarizing a set of empirical observations in a functional statement. Any attempt to squeeze connotations regarding utility or welfare out of such data is at best a dubious practice, and at worst simply a *non sequitor*. The slope and position of statistical economic-demand curves is largely a function of income distribution *(Seckler 1966)*. In estimating recreation benefits, we are dealing with a vague utility function. We are attempting to estimate marginal utilities in a context where we cannot quantify prices, and cannot operate within the rules of the market.

Some of the first research attempts to forecast recreation participation involved gravity models, as developed by Clawson *(1959)* and later described by Cesario *(1969)*. A gravity model stipulates that as distance from a recreation facility increases, the use of that facility decreases according to some mathematical function (fig. 1). Going one step further, some researchers suggest that the expenditures incurred in traveling to and from a facility, plus on-site expenditures, reflect the value of the recreation experience. Therefore, travel and on-site costs incurred throughout a range of distances from a facility provide an estimate of economic demand for that facility. Thus the gravity model is nothing more than the first step of a two-step procedure

Figure 1.



for developing an economic-demand curve for a recreation complex or region.

Using this method, Allen and Whaley *(1968)* developed a model that predicted overnight occupancy of campgrounds in the Cache National Forest in northern Utah. The gravity-model phase of the experiment predicted use of a total camping complex on the Forest per 100,000 population residing as various origins from the complex. The number of competing camping alternatives within a 75-mile drive of each population origin was also included as a variable in the model. The resulting equation explained 57 percent of the variation ($R^2 = 0.57$) in camping use within the camping region studied. In the same study, 74 percent of the variation in fishing-use intensity of two streams in the Uintah Mountains of Utah was explained by using round-trip distance (in miles) between a stream and a given county of residence, plus two additional socio-economic variables.

A study by Smith and Kavanagh *(1969)* in England showed how the number of visits per 10,000 population from urban areas within an 80-mile radius of a 1,570-acre reservoir were estimated quite reliably ($R^2 = 0.69$) by knowing the distance of a given urban population-density zone from the reservoir. When population density in both urban and rural areas around the reservoir was included, the resulting model explained 90 percent of the variation in reservoir use.

Wennergren and Nielsen *(1968)* determined the relationship between the number of boating trips taken by a sample of 9.2 percent of the boaters in two northern Utah counties, and the travel distance between a respondent's residence and a given lake. The resulting equation explained 80 percent of the variation in the probability that a given recreationist would visit any one of 22 alternative water-recreation sites.

Influence of On-Site Characteristics

Methodologies have been devised that depend largely on the physical site characteristics of a particular recreation area, such as lake size, size of swimming area, miles of ski trails, number of campsites, number of parking places, amount of money that management spends on advertising, or distance from population centers (the gravity-model effect) to determine the amount of recreation use to expect at a specific recreation area.

For example, average annual visitor-days per campground, for 24 Adirondack campgrounds, was described by a model that used four on-site variables. The model had an R^2 of 0.98. A visitor-day was defined as one camping party using one tent or trailer site at a campsite in a given campground for one day *(Shafer and Thompson 1968)*.

In another study, total recreation visits at any one of 154 outdoor recreation sites in the Appalachian Region throughout six Northeastern States was forecast with a model that contained four supply variables and one management-procedure variable (fee vs. no fee). The R^2 was 0.74 *(Seneca and Cicchetti (1969)*.

An equation that explained 71 percent of the variation in total visitor-days per ski area for 26 ski resorts in northern New England and New York used three site variables plus a distance measurement (a gravity-model feature) from major northeastern metropolitan areas. One visitor-day was defined as one skier visiting a ski resort during any part of one day. The same study described how, during a winter season of comparatively poor snow accumulation, money spent on various types of advertising significantly described ($R^2 = 0.83$) the number of visitors a ski-lodge manager could expect *(Echelberger and Shafer 1970)*.

The essential point of these and similar studies has been to show how supply-oriented variables can be used to estimate quite reliably (based on R^2) the amount of use an outdoor-recreation facility may receive. However, there are several important underlying assumptions that need to be considered in judging the usefulness of equations that result from this type of research approach.

For instance Seneca et al *(1968)* argued that supply variables, rather than socio-economic characteristics of recreationists, should be used in the development of recreation-consumption models because the

growth in income and leisure time, together with changing attitudes of the population, have reduced the relative importance of the traditional constraints of travel cost and distance. Seneca *et al. (1968)* pointed out:

> The "costs" of a 200-mile trip to the head of a family who owns his car, a two-week paid vacation, and a desire to get out of the city, are not nearly as important in his decision to travel as is his knowledge that when he arrives at the site both the *natural environment* and the *physical facilities* he desires to use are in fact present and obtainable.

The inference here is reinforced later when we discuss the influences of user characteristics on recreation participation and examine how R^2 values resulting from prediction models generally are much lower than for supply-oriented prediction models.

Also, some sites used in the development of supply-oriented equations will be overused—as indicated by the use-intensity at overflow areas—while other sites will be at or below capacity (regardless of quality of the recreation experience). Accordingly, the resulting estimated user-response equation implicitly will reflect an *average* quality of a recreation-day based on the actual use conditions at the number of sites examined at a particular point in time. Seneca and Cicchetti *(1970)* explain that estimated use from a supply-oriented equation does not necessarily imply the actual capacity of the sites. Capacity cannot be determined without defining explicit *quality* criteria. Obviously there is a research need for better understanding of recreation capacity in relation to the problem of a quality experience. More about this later.

When using an equation that relates recreation use-intensity to recreation-supply variables, one should not confuse the predicted recreation use with economic demand; and also, one should not assume that supply of facilities will generate the associated economic demand. More explicitly, a use-prediction equation that involves supply variables will yield quantitative indications of the number of recreation visits that could be accommodated within the bounds of present supply conditions. Such an equation can also provide some knowledge of the substitution possibilities among the various recreation-supply alternatives available to the recreation planner.

Furthermore, in an equation that relates use intensity to on-site supply characteristics, the amount of user-days generated by the equation is conditional on the presence of demand. Therefore a model that predicts use on the basis of supply variables is *not* equivalent to an economic-demand function. When supply-oriented prediction models are developed, the question remains as to whether economic conditions are such that the predicted amount of recreation will still occur if additional supply conditions are developed according to the combination of supply variables specified in the model. In this regard, perhaps an independent recreation-use-pattern study is needed for the geographic area and user population being considered. The results of this kind of study should then be combined with results from supply models for the same geographic region. (The supply model indicates the availability of recreation opportunity, given certain supply conditions.) An allocation of the projected future demand can then be made to determine whether and where shortages exist in recreation supply.

A further difficulty remains, however, if shortages in recreation opportunities are detected for a given geographic area—which is usually the case in this era of increasing recreation demand. From an economic standpoint, this crucial problem requires the *valuation* of a recreation experience, and the subsequent justification of increased recreation supply.

The valuation of a recreation experience is an important but thorny problem. Valid objections exist in the literature for *all* the economic-valuation methods of recreation-participation patterns. In this regard, recreation-resource managers would be well advised not to worry about the peculiarities of an economic valuation approach to justifying recreation expenditures, but rather to concentrate on the more fundamental problems of justifying their decisions on the basis of how use-intensity is influenced by the quantitative values of recreation supply, consumer characteristics, and qualitative aspects of the recreation experience.

Influence of User Characteristics

Another kind of equation for forecasting recreation consumption utilizes socio-economic characteristics of a given population. These variables include such items as annual family income, education of household head, and occupation.

For instance, a recreation activity-scale value) which reflects user participation in 11 different kinds of outdoor recreation activities throughout the United States) can be predicted by using nine socio-economic variables. This model has an R^2 of 0.30 *(Mueller and Gurin 1962)*.

In a comprehensive study of socio-economic data collected by the Outdoor Recreation Resources Review Commission (ORRRC), Kalter and Gosse *(1969)* developed recreation-participant demand functions for residents of 12 planning regions in New York State. Thirteen socio-economic variables were involved in the models, which examined overall participation, vacation trips, and outing participation in the five recreation activities for 1960 and 1965.

The range of R^2 values for the 74 resulting recreation-demand models were:

R^2 range	*Number of models with R^2 in this range*
0.01 - 0.10	9
.11 - .20	12
.21 - .30	13
.31 - .40	10
.41 - .50	11
.51 - .60	10
.61 - .70	5
.71 - .80	4

Variables that did not explain a significant proportion of total recreation participation were retained in the models when the authors considered such variables as important. This procedure may have accounted for some improvement in R^2 values.

Cicchetti *et al. (1969)*, also using ORRRC National Survey data, developed recreation-use participation models for 24 types of activities in 1960 and 1965. Most of the independent variables used in the models were socio-economic characteristics of the American public, plus a few supply variables (including landscape-classification standards). The range of R^2 values for the 79 resulting models were:

R^2 range	*Number of models with R^2 in this range*
0.01 - 0.10	27
.11 - .20	20
.21 - .30	2
.31 - .40	1

One of the most successful recreation-participation models involving socio-economic characteristics was developed by Gillespie and Brewer *(1969)*. Using 17 socio-economic variables that can be measured from United States Census data, their model explained 62 percent of the variation in annual water-oriented outdoor recreation-days per family for residents of St. Louis, Missouri.

What Prediction Method to Use

Gravity models seem most appropriate for forecasting demand for relatively small homogeneous regions where vegetation, terrain, and water-recreation resources are fairly uniform. The general form of this kind of equation is:

$$U = f\ (\text{Distance})$$

and it is read, use (U) is a function (f) of distance. That is, the number of people (U) from a series of population centers who will use a given recreation area can be predicted by knowing the distance from the recreation area to a population center.

The economic-demand model, a byproduct of the gravity model, may be useful for forecasting economic demand for recreation activities where a realistic entrance, or participation, fee is involved—such as commercial campgrounds, ski resorts, snowmobile developments, or commercial hunting-fishing enterprises. An economic-demand model can also be useful for predicting the change in demand for public facilities that may result from fee changes. The general form of this model is:

$$U = f\ (\text{Costs})$$

In other words, use at a specific facility is related to costs incurred in traveling to and from the facility, plus on-site admission costs.

Use-prediction equations that involve measurements of on-site supply characteristics at recreation facilities generally result in higher R^2 values than gravity models

(except when gravity models are limited to small homogeneous recreation complexes). Recreation-supply characteristics used in such models should be contained within the same physiographic area—such as the Adirondacks or the Appalachian Region. Including travel distance with on-site characteristics in the same model seems to increase the resulting R^2 value. The general form of this equation is:

$$U = f \text{ (Supply)}$$

Specifically, use of a recreation facility is related to on-site characteristics of that facility.

Equations that employ recreation-user characteristics to predict recreation-use patterns seem most useful for management and planning purposes when a homogeneous population of users and a fixed supply condition are involved. When a travel distance variable is included with the socio-economic valuables, the R^2 value seems to improve slightly. One distinct advantage of the socio-economic model is that the data necessary to develop the model may be obtained quickly and inexpensively from U. S. Census tracts; and future data for the equation can be obtained periodically thereafter to determine any shifts in the values of independent variables. For example, the socio-economic model may be useful for forecasting consumption of National Forest recreation opportunities that surround a given urban-suburban area. A separate model can be developed for each city. The general form for the model is:

$$U = f \text{ (User Characteristics)}$$

In this case, use or participation in a given activity for people living in a specific population center is related to their socio-economic characteristics.

In summary, the best approach to developing predictive recreation-use models may be to include distance, supply, and socio-economic variables in the same equation:

$$U = f \text{ (Distance, Supply, User Characteristics, Qualitative Values of the Environment)}$$

The inference drawn from such an equation, if it works, would be that recreation use (U) expected at any one of a number of recreation environments, and emanating from any one of several population centers, is related to distance from the environment to the population centers, supply characteristics of the environments, and user characteristics in the population centers surrounding the environments. If the *qualitative* values of an environment are inserted in this last equation, the predictability of the equation may be improved. The problem here, of course, is to quantify these so-called intangibles. That's the next subject.

EFFECTS OF QUALITATIVE VALUES ON PARTICIPATION

When considering qualitative values of recreation participation, management is playing in an unfamiliar ball park. Essentially, the name of the game (meeting the needs of outdoor recreationists) hasn't changed, but in this ball park the base lines are not clearly marked, and managers need to be extremely careful not to hit a foul ball and think it's a home run. One of the most difficult problems in outdoor recreation management is not one of forecasting and accommodating sheer *quantities* of visitors, but of allocating resources and funds that can accommodate recreational experiences of varying *qualities (Schoenfeld 1968)*. Qualitative recreation values involve such intangibles as security, beauty, pleasant feelings, health, freedom from stress, and self satisfaction.

The Best Recreation Environment

Webb *(1967)* pointed out, when discussing the qualitative values of wildlife, that "citizens are seeking ways to challenge their intellectual curiosity and utilize their creative energy" through recreational experiences; and in this regard, resource managers should "no longer be forced to play the cost-benefit game" of providing the intangible benefits of such experiences. Webb's inferences seem appropriate to the management and enjoyment of all natural recreation resources.

But how can recreation environments be developed to provide maximum intangible benefits for man? In the case of animals

there are at least some guidelines. In an optimal environment, a wildlife species maintains its balance of births and deaths and does not destroy its environment. Recreation-resource managers cannot control man's birth rate, but they can obviously exert pressures to insure that man does not destroy his forest-recreation environments.

Determining the best forest-recreation environment for man—such as stipulating optimum tent-site spacing, defining how many acres of water are needed to enjoy a day's fishing, or determining how large an area of undisturbed wildland environment is required for one man to contemplate the values of nature—will not be an easy task. These kinds of challenges call for value judgments as to what is meant by an environment being *the best for man (Osmond 1965)*.

The Need for Territory and Status

One might begin to explain what is best for man by examining how the anthropological nature of man relates to his leisure behavior patterns. Certainly, a principal cause of today's recreation-demand explosion is the affluent combination of more money and more leisure time in which to spend it. But an even more basic factor contributing to man's search for a place in the great outdoors probably is related to his biological makeup.

From our ape ancestors on the African veldt, Ardrey *(1966)* suggests, man has acquired an imperative need for "territory". Man, Ardrey proclaims, is as much a territorial animal as a "mockingbird singing in the clear California night". Ardrey implies that man acts as he does for reasons of his *evolutionary* past—*not* his cultural present—and that his behavior (including leisure) is as much a mark of his species as "the shape of a human thigh bone or the configuration of nerves in a corner of the human brain".

For instance, if certain segments of the public defend the aesthetic quality of a forest environment against development because they feel the forest is part of their heritage; or vice versa, if public or private managers claim the right to develop that same forest in the manner of their choosing because they own or manage it, individuals in each instance react the way they do, Ardrey argues, for reasons no different, no less innate, no less ineradicable, than do lower animals. As Ardrey points out, "the dog barking at you from behind his master's fence acts for a motive indistinguishable from that of his master when the fence was built". Ring-tailed lemurs, prairie dogs, robins, tigers, and Atlantic salmon, fence lizards, herring gulls, monkeys, and man—all of us will give everything we have for a place of our own, or to maintain what we already have. This theory applies particularly to the territory man uses for leisure-time enjoyment; including the shade from a tree in his own back yard to the majestic snow-capped peak of a distant mountain.

Thus the clamor of certain groups for preservation of forest environments, the ringing condemnation of resource managers by other recreationists for not building more recreation areas, or reciprocal reactions from some forest owners or managers to defend their rights to develop their forest as they please, involves a force far greater than a mere social reaction of our times.

Territory in the evolving world of animals, whether that territory be one's favorite hiking train, campground, boating area, fishing spot, or one's silvicultural responsibility, is "a force perhaps older than sex" *(Ardrey 1966)*. It is well to keep this point in mind when weighing the pros and cons of management and research efforts designed to help solve the almost overwhelming problem of meeting the qualitative aspects of recreation demands and values.

The Need for Recognition

Considerations other than an imperative territorial need may influence man's intangible outdoor-recreation values. For instance, Morris *(1969)* described how the need to be recognized as a member of the leisure class also influences behavior patterns and value systems of recreationists.

In relating how man inevitably tries to establish a status among his fellow man that is somewhat above the average, particularly where leisure behavior patterns are con-

cerned, Morris *(1969)* uses an analogy between man and insects. For example, Morris points out that many kinds of insects are poisonous; so larger animals learn to avoid eating them. It is in the interests of poisonous insects to show a warning flag of some kind, such as the way a wasp displays black and yellow bands on its body. Predators know these markings and avoid wasps. Other harmless and unrelated nonpoisonous insect species "have taken advantage of this system by developing color patterns similar to those of the warning club" and . . ."by becoming fake members of the warning club they reap the benefits (underlining ours) without having to possess any real poison" *(Morris 1969)*.

This insect example can be used as a crude analogy to help us understand what has happened to the human status seeker. Simply by "wearing the flag" of dominance, certain individuals say they could be in a certain status level if they wanted to. It follows, naturally enough, that harmless subordinates can join the "dominance club" and enjoy its benefits if only they can display the same flags, or at least create an illusion of dominance.

The system works like this in outdoor recreation. At any particular moment in recent history there has always been a highly functional costume to go with the high-status sport of the day. To wear ski apparel, for example, indicates that you can afford the time and money to indulge in this expensive sport. This status display can be enhanced by wearing stretch pants and a ski jacket—with several lift-tickets stapled to the collar—as ordinary day clothes—even when not actively participating in the sport. The wearer is emanating signals that say, "I am very leisured"; and such signals can say this almost as well for a non-skier. However, when the attire is accepted as everyday wear, it loses its impact, Then a new sport, preferably a dangerous one, has to be raided for its unusual costume.

The illusion of dominance is not constrained to wearing apparel. Some other obvious examples in outdoor recreation behavior patterns include: the sportsman who has a variety of decals on his field jacket; the fisherman who simply must have a fly for every occasion; the camera buff who must have a variety of cameras dangling around his neck; the hunter who has a series of rifles or stuffed big-game heads hanging in his den; the camper who has a mirage of decals sticking on his trailer; or the wilderness hiker who simply must have the 2½ ounce (rather than the 3½ ounce) sub-zero sleeping bag in his pack. Such examples are almost endless.

These are some of the intangible values that are an important part of recreation behavior, but that are very difficult to examine, let alone measure. Nonetheless, such values play an important role in man's leisure-time behavior and participation patterns. Herein lies an exciting challenge to research, in terms of basic methodology and comprehensive experimental design, that can lead to improved understanding of intangible recreation values. These values are key elements in understanding man's relation to his recreation resource. A few examples of recent research that should be helpful in formulating new methods of measuring intangible values include studies by Lansing and Morans *(1969)*, Kasmar *(1970)*, Neulinger and Breit *(1969)*, and Bultena and Klessig *(1969)*. A thorough literature review—an important prerequisite to any research—undoubtedly will uncover many more important references.

Amenities

As yet, research has not really predicted with any reasonable accuracy the effects of different recreation use-intensities on the qualitative values of a given recreation experience—although it is now possible to begin to observe and measure certain kinds of recreation amenity values, or at least some indicators of those values.

As more and more people cluster into outdoor recreation facilities and environments—in much the same way that they are clustering into urban regions—their effect on the natural environment becomes an increasingly important factor to consider in forecasting future recreation-participation patterns. In a sense, the most important recreation values that forest resources can provide for society, and the individual, are virtually being loved to death in some of

this Nation's most scenic areas. Recreationists inadvertently are destroying, through overuse, some of the most scenic resources they seek to enjoy. In these kinds of resource-management environments the major problem is not to forecast future *increases* in use, but rather to predict how certain management regulations and procedures can *limit*, or even *decrease*, recreation use-intensity. Much of the concern for predictions of this type are centered around the idea of amenity resources, a concept that requires clarification and better understanding.

In discussing amenity resources for urban living, Atkinson and Robinson *(1969)* defined amenities as "those stimuli which lead to feelings of comfort, pleasure, or joy", a description that can also apply to amenities in outdoor-recreation participation. Atkinson and Robinson *(1969)* went on to explain that amenities "make up one of the outputs derived from man's environmental system; that these outputs can be managed; and that decision criteria and management systems can be developed to accomplish this task in a rational and socially responsible manner". Although Atkisson and Robinson used an urban example to show the several components involved in any amenity-response system, the components of their system can just as easily be used to describe outdoor-recreation amenity values:

Component in the system	*Example of Output*
Amenity stimulus generator (or participant)	Lake shoreline in undistributed wildland area.
Respondent	Hiker walking along the shoreline.
Amenity values	The pleasure of the view evoked by the lake and the surrounding mountains. Cool breezes. Sound of waves breaking on the shore. Seclusion.
Response to amenity values	Support for maintaining environment in natural state. Frequent walks along the shore.
Potential disamenities	Motorboat noise. Recreational development of shoreline. Logging on surrounding hillsides.

But a problem arises when applying such amenity-response systems to management problems; the system does not describe human response to resource amenities in *quantitative* terms. In this regard, however, research techniques are already available that may prove useful in approaching this sticky problem.

Relevant Past Research Efforts

A few examples of quantitative-measurement techniques for assessing the value of environmental amenities include *(Craik 1968)*:

1. Adjective checklists for respondents to record their impressions.
2. Activity or mood checklists to be used by unobtrusive observers.
3. Q-sort decks, consisting of 50 or 100 statements, each on a separate card and each expressing an important characteristic, which are sorted by an observer into piles of specified numbers along a dimension ranging from "most characteristic" to "least characteristic" of the item being evaluated.
4. Rating scales, including preference ratings and semantic differential scales used by respondents.
5. Viewing time, or participation time.

A few recreation-research studies have used some of these techniques to quantify amenity values, and have resulted in equations somewhat like those discussed previously under the effects of quantitative values on recreation participation. In a study aimed at developing a quantitative preference score for visual characteristics in natural environments, Shafer *et al. (1969)* explained 66 percent of the variation in preference scores for a wide range of natural-resource environments depicted by black and white photographs. Preference scores for individual photos were obtained by having respondents rank the photographs. Six variables representing different quantitative features in the pictures were used in the final scenic-preference model developed from the field-interview data.

In a similar study, Peterson and Neumann *(1969)* determined preference weights for

black and white photographs of a variety of swimming beaches in the Chicago area. A significant 94 to 98 percent of the variation in preference scores was explained by quantitative values derived from semantic-differential scale ratings that were obtained in personal interviews of beach users.

In examining preferences for visual appearance of residential neighborhoods in the northern half of the Chicago metropolitan area, Peterson *(1967)* used 23 projected color photographs of residential neighborhoods, and asked respondents to rate an appropriate scale for each of 10 variables. A resulting preference model included nine variables that explained 99 percent of the variance in preference scores for the scenes.

Shafer and Mietz *(1969)* computed an attitude scale that showed the relative quantitative value of each of five qualitative wilderness values. The scalar values computed in the study are a basic first step in quantitatively defining, for management decisions, the relative importance of "intangible" wilderness values.

The Right Units of Measure

In many respects, studying qualitative recreation values involves walking where angels fear to tread. There are many people who shudder at the thought of bringing a quantitative measuring instrument into the domain of intangible recreation values, such as aesthetics for example. It is necessary to draw a sharp distinction here between a study of the process of aesthetics as a kind of human reaction, and the *creation* of aesthetic environments. Whereas the latter should, and undoubtedly will, remain in the domain of the artist and landscape architect, the former is a perfectly legitimate area of scientific study, and any instruments or equations (quantitative or otherwise) that facilitate this type of research should be welcomed *(Osgood et al. 1957)*. The same reasoning applies to the quantification of other intangible recreation values as well.

But even among those who agree that research on this subject is necessary, some will argue that any description of qualitative values should be done with qualitative measurement devices, but there are inherent difficulties in this approach. Consider an experiment, for instance, where three respondents are asked which of two activities —fishing (F) or mountain climbing (C)— provides more pleasure. (The amenity value involved in this experiment could just as well be self-reliance, aesthetic enjoyment, exercise, or some other intangible value other than pleasure). Suppose the results of this inquiry were as follows:

Individual	*Fishing (F) or Mountain Climbing (C)*
1	F > C
2	F > C
3	C > F
	Conclusion: F > C

Note: The symbol (>) here means "is liked better than."

One concludes from the results that two out of three, or the majority of the respondents, derive more pleasure from fishing than from mountain climbing; that is F> C. But now suppose we introduce an additional activity into the experiment, such as swimming (S), and ask each respondent to rank the three activities–from the one that gives him the most pleasure to the one that gives him the least pleasure. Furthermore, in this second phase of the experiment, suppose none of the respondents changes their initial response. Now the results might look like this:

		Second experiment in so far as — —		
Individual	*First experiment*	*Climbing is concerned*	*Fishing is concerned*	*The remaining possibility is concerned*
1	F > C	C > S →	F > C →	F > S
2	F > C	F > C →	S > F →	S > C
3	C > F	C > S →	S > F →	C > F
		C > S	S > F	
	Conclusion: F > C		C > F	

Note: The preferences in the first experiment are underlined in the second experiment.

The problem that we now encounter is that we directly contradict the conclusion of the first experiment involving a choice between C and F alone. (Obvious, isn't it?) Now C> F. Yet, none of the respondents changed his mind in the second experiment concerning C and F. The reason for this contradiction is easily given: the two statements "F> C" in the first experiment were split in the second experiment. This kind of paradox can result from almost any experiment where qualitative value scales are used to evaluate people's feelings, and the preferences are summarized for any one activity. In experiments of this type, it is important to use an appropriate measurement technique (or even invent a new one), and to include a control for all those variables that account for significant amounts of variation in whatever is being measured. Obviously the procedure presented in this example is not the best way to summarize the data.

The most critical research challenge lies not only in developing hypothetical models of human response to amenity stimuli as typified in Wagar *(1967)*—which is a step in the right direction—but more important, in *quantifying* the satisfaction values of those amenities.

In the real world of recreation participation, the number of variables that should be examined is probably much more complicated than described in the following example, but a simplified example will suffice to explain the necessary relationship that should exist between models that forecast expected quantities of recreation users, and models that describe associated qualitative values. *Both types of models should predict results that relate to the same units of measure.* Otherwise managers will be faced with the same old dilemma of trying to mix apples and oranges and come up with a decision. For instance, suppose research developed the equation:

Total maximum number of boats on a lake

= f (lake size in acres).

But presumably, recreation-resource managers should not make a meaningful decision about how many boats to allow on any given lake until they know the effect, if any, of varying degrees of boat-use intensity on user-satisfaction. In this respect, suppose research provides management with an additional equation that relates user-satisfaction to number of boats/acre on any given lake:

Degree of user-satisfaction =
f (number of boats/acre of lake).

Now the manager has the information to make a tentative decision. Assuming that total boat-use increases with lake size, a level of demand can be predicted for boating on a certain size lake. Using this consumption curve, the manager can calculate a boat/acre value for any projected total boat-use value (fig. 2). Now, assuming that user satisfaction decreases as boat-use intensity increases (fig. 3) the manager can determine the influence of any given level of boats/acre on user satisfaction; and the tradeoffs between boat density and user satisfaction can be evaluated in arriving at the final decision about how many boats per acre to allow on the lake.

This simplified example underscores the reason why research on amenity values and user-participation rates should proceed simultaneously in the same research study whenever possible.

It is imperative to mention here that in

Figure 2.

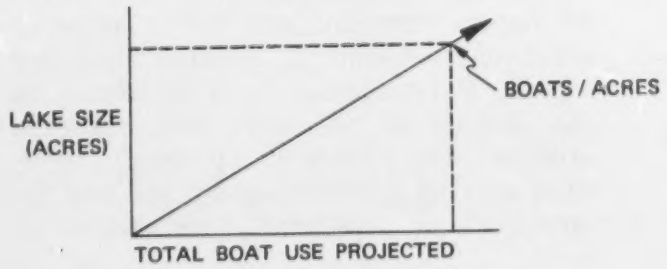
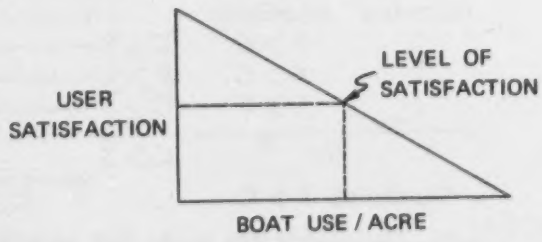


Figure 3.



addition to amenity values and participation-rate models, other information such as a forecast of technological advances that create new types of boating equipment, is needed in the previous example before management can make the *best* decision.

TECHNOLOGICAL IMPACTS ON *ALL* RECREATION VALUES

The quality of recreation experience depends largely on the quality of the recreation environment; but the quality of both the experience and the environment can be significantly affected by technology. A key management challenge is to predict potential management problems associated with technological developments as they relate to amenity values and use patterns of recreation resources.

In forecasting future demand patterns and their effect on the environment, recreation-resource decision-makers must inevitably be concerned with future technological developments in recreation-equipment design and environmental control. Current breakthroughs in technology are conditioning the quantitative participation rates and qualitative values of today's recreationists. Management's reactions to technological breakthroughs comprise one of the major problems in recreation-resource management—not just today or tomorrow, but continually.

Breakthroughs in Recreation Equipment

A simple and fairly typical example may help to illustrate the point by referring to a full-page advertisement that appeared in LOOK magazine a few years ago (10 October 1965: p. 12). On the upper half of the page was a picture of a moonlit evening in a campground, with a family happily watching a TV set outside their modern trailer. Under the picture was the caption:

> "Today, abundant electric service brings conveniences to the campsite . . . Wherever you look today, electric service makes good things happen."

The lower half of the page contained a picture of majestic mountains and lakes, with the same family as before, but this time they were zooming across the sky in a vehicle of the future. The caption read:

> "Flying mobile camper of the future may be electrically powered—plugging into any outlet for recharging . . . Imagine what (electric power will) do for your tomorrow . . . It's your desires and dreams that spur us on . . . You'll never outdream your possibilities."

Fascinating! Considering the fact that man just began to fly at the turn of the century and is now walking on the moon, such developments as a flying mobile camper are just around the corner in recreation-resource management.

When this type of equipment is sold commercially, who is going to be responsible for deciding where and how these flying mobile campers will be used in wildland areas? Who is going to provide the electric outlet for recharging it? Who is going to have to decide how many of these vehicles can be safely used in a given area at one time?

The recreation-resource manager, that's who—you better believe it!

But the manager cannot wait to start thinking about how to answer these questions until flying mobile campers, or other fascinating types of recreation equipment, are on the commercial market. There are too many other things to think about at one time when that occurs. We had better start thinking about such technological developments before they happen, so that the resulting problems can be solved in the light of recreation-activity mixes that satisfy demands for a multiplicity of recreation activities.

Breakthroughs in Other Fields

An example of how technology, even in a non-recreation field, may ultimately affect recreation travel patterns is illustrated by the present state of research development of the picture phone *(McHale 1969)*. Much of the airline business today is *business* travel that provides needed face-to-face contact between seller and buyer. In the not-too-distant future, airlines will compete with the picture phone for conducting business transactions. Present technological forecasts suggest that the cost of

conducting business by picture phone will be much less expensive and just as effective as present air travel to accomplish the same purpose. As a result, airlines may appeal to the recreation market with all sorts of charter flights and special-rate flights to favorite recreation spots throughout the country and around the world. Imagine what effect this technological breakthrough in the picture phone will have on recreation-demand patterns!

Predicting the Future

How can technological progress that affects recreation demand be predicted? Several procedures have been compiled by Bright *(1968)*, Helmer *(1966)*, Stover *(1969)* and North and Pyke *(1969)*. Most of these techniques are based largely on trend extrapolation, on studying the effects of technical breakthroughs in one field of study on important changes in a seemingly unrelated area of management or science, or on the Delphi method—a survey procedure for obtaining a consensus of expert opinion.

From a recreation manager's standpoint, it would be ideal to have an estimate as to when relevant future technological events are likely to occur. Timber-production plans extend 50 to 60 years into the future, so why not probe 30 to 40 years into the future for possible shifts in recreation-demand patterns for the same resource environments? Some managers feel that "there are too many of today's recreation-management problems that need to be solved first". In recreation management, that type of philosophy is like having a chance to go on the maiden voyage of the Titanic, knowing the consequences, and then booking first-class passage. Today's revolution in recreation-equipment use and resulting changes in behavior patterns is merely the sputtering of a fuse of a much larger explosion that is about to come.

Technology will shape the future of recreation demand; it will create new possibilities for management to solve demand problems; it will alter the mix of choices available to meet recreation demand; it will influence individual and social values of recreation; and it will undoubtedly alter the conditions and patterns of present management practices. For these reasons, any overall approach to forecasting future recreation demand should include research on the effects of relevant technology.

A FEW LAST WORDS

The primary objectives of any study in this area of research should be:

- To develop a conceptual model (hopefully a mathematical equation) that permits estimates of probable tangible or intangible values of recreation use for a given facility, site, or piece of equipment.
- To apply the model to empirical data for the purpose of comparing actual and predicted values for one or more types of recreation activities.
- To illustrate the application of the probabilistic analysis in the development of statistical use estimates for outdoor recreation *(Wennergren and Nielsen 1968)*.

The central task lies in the exploration and methodological investigation of several ways to forecast recreation values. These approaches may range from evaluation of the past; to the study of human trends and needs in the present; to the projection, forecasting, and imaginative construction of several future individual and social patterns of recreation consumption.

There is no good answer to the question of how far recreation values should be projected into the future. It depends. The magnitude of any future projection is most often influenced by the reliability of the data, how far it extends into the past, the associated variation in the data, and the expected time interval between the beginning and the end of any research study. It makes little sense, for example, to do a 5-year recreation-demand forecast with data if the research study itself takes 3 years to complete.

Lenz *(1968)* offered a word of caution to those who attempt to forecast the future when he paraphrased Dante's warning in the *Divine Comedy:* "All forecasters must

circle endlessly about the bottomless pit in Hell, with their heads turned backway on their shoulders, so that their copious tears will flow down the cleft of their buttocks, because they tried to look too far ahead."

So we must be careful!

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DESIGN & LAYOUT OF RECREATION FACILITIES

by HOWARD R. ORR, *Regional Landscape Architect, Division of Recreation and Watershed, Southern Region, USDA Forest Service, Atlanta, Ga.*

ABSTRACT. Design and layout of recreation facilities is a problem-solving process that must be divorced from the emotionalism that has shrouded outdoor recreation and must deal deliberately with the growing information concerning people and natural resources.

DESIGN AND LAYOUT of recreation facilities is the last major step in a long chain of events leading to public enjoyment of basic resources. It is in this stage where environments are modified or created after many hours of research and planning aimed at solving the mysteries of man and his needs and the site and its capabilities.

Design, like any other problem-solving process, requires that you know the problem before you can hope to solve it. The more you know the better your solution is apt to be.

The results of poor solution range from no use of the site to failure of the site. No use usually indicates lack of knowledge about the market—people. Site failure is the result of lack of knowledge about the site. Of course there is always the possibility that the designer does not know what to do with the information he does have.

Though it is very rare that no use will result, this is not because we have known much about people. More likely it is the result of overdemand, and that people will use very poor facilities when there is relatively little choice.

Site failure has caused some rather strange reactions: a turning to cure-all plant materials that are both beautiful to behold and will withstand the trampling of thousands of visitors, and frantic poring over fertilizer lists to find something to strengthen vegetative growth.

What causes site failure? Too many people. Too much use.

How many people should a site be able to stand?

If you own or operate a campground or recreational development of some kind, you know very well how many people must stay how many days for you to break even.

What about public agencies? The public should be able to expect—no it's even stronger than that: they have a right to know—that our investment of their money realizes values for them that are at least equal to cost plus the going safe rate of return. In other words: we should make some calculations also.

$$\frac{\text{Total social cost + safe interest over the amortization period}}{\text{Total social value of one visitor day}} = \text{Number of visitor-day use necessary to justify the development.}$$

$$\frac{\text{Visitor day-use necessary to justify}}{\text{Total possible visitor days in amortization period}} = \text{Percent of theoretical capacity use needed to justify the development.}$$

You will find that it takes 50 to 60 percent of capacity use to justify the cost on a 50-unit campground. If your campground is receiving less use than this, and the site is deteriorating, you are really in trouble. And obviously constructing more of the same to "relieve the pressure" is not the answer.

IMPACT OF USE

The disease producing the symptoms is not just too much use or too few developments. The site is receiving *more impact per visit* than it can stand.

A site has a built-in capacity to withstand impacts. You can exceed this limit by applying the full impact of a few visits or the reduced impact of many visits. Different designs produce different impacts.

We can squander the carrying capacity of the site or we can use it wisely. Most of the impact problems we all have are due to poor utilization of the recreation resource.

We have not thought of recreation as a product. Because it involves the psychological well-being of man and is closely tied to freedom of choice and esthetics, we hesitate to put dollar signs on it. We have feared and rejected with righteous indignation the obviously evil intentions of anyone speaking of economic justification.

This particular stand has done much to retard progress.

The fact is, outdoor recreation is a product, a commodity that our society finds essential, one that vast numbers of people pay for, one so important that it is government-subsidized. It is my belief that significant progress depends on recognizing this and beginning to manage production of recreation as scientifically and as economically as other natural-resource-based commodities.

At least partially because of this "esthetic detachment" from reality, it was thought until recently that facility placement in recreation development was not important as a variable in site deterioration. In actuality it turned out to be second in importance among 38 variables tested in a Forest Service administrative study. Measuring the design potential for creating pedestrian impact was an important problem. A system developed for determining this is known as PPI or Potential Pedestrian Impact.

It was built on the following analysis. Recreation falls under the broad category of an activity of choice and is less subject to control than one of necessity, such as living and work activities; but within the broad category of the activity, recreation, there are subcategories or subsets of activities—knowns, predictables, and unknowns.

Knowns are activities or movements of necessity, those that we know must take place for people to use the site or development. They must be solved for in the design and require definite recognizable design statements. Predictables are activities of choice involving predictable patterns of movement. They are solved for in the design by both definite design statements and the application of design psychology. Unknowns are activities or movements subject to random selection and the whims of the users. They involve design psychology and overdesign (built-in safety factors).

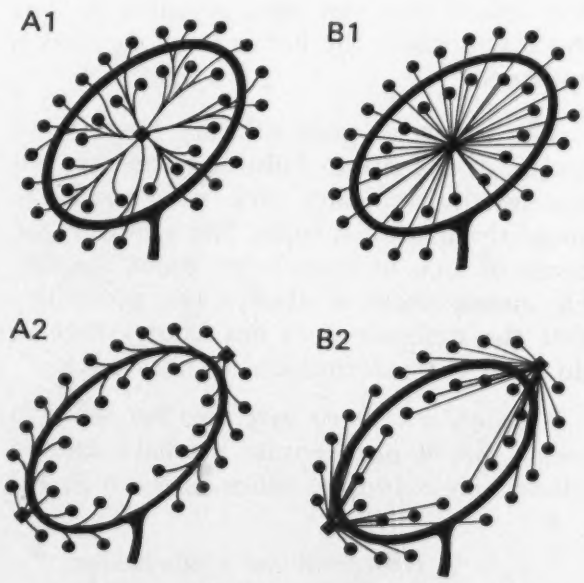

Figure 1.—Patterns of movement. A1 and A2 show actual pedestrian travel from a camping unit to known points of use. B1 and B2 show the travel as straight lines.

Since activities of necessity or knowns are usually repeated in the same pattern of movement, thus creating repeated impact, they are of vital concern when considering impacts on the ecological balance being disturbed by site design, construction, and use. It is also the portion of site impact resulting from use that is most controllable through design and is thus an indication of the "quality" of the design.

For example, how a pedestrian might actually travel from his camping unit to points of known circulation is shown in figure 1, A1 and A2. The problem here is that if 12 different people made diagrams on a particular site, you would get 12 separate answers, all different.

The use of straight lines between these same known points of circulation is shown in figure 1, B1 and B2. Though people do not actually travel in straight lines, a straight line between two points will be drawn the same, no matter who does it. The relative difference in potential impact between A1 and A2 is the same as that between B1 and B2.

In actual practice, the lines are drawn on an accurate scale drawing of the design, such as the 50 scale general plan (fig. 2). The portions of the lines that do not fall on facilities or reinforced points of the site such as tent pads, parking spurs, roads, and surfaced paths are measured to scale, totaled, multiplied by 3, and divided by the total area within 50 feet of all units.

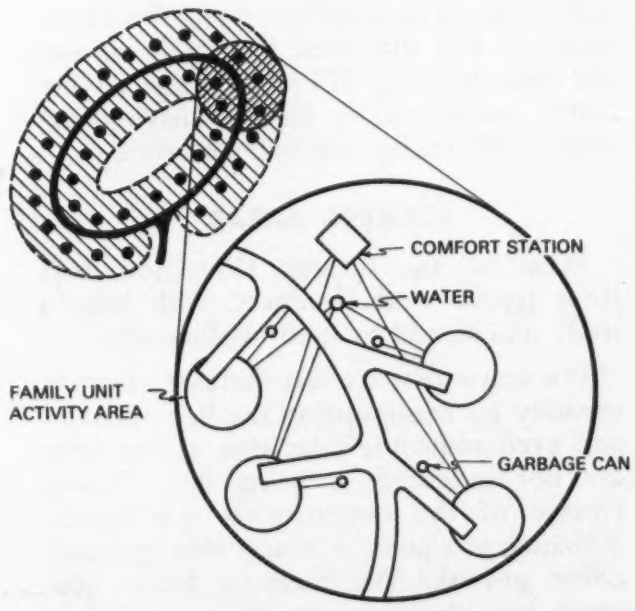

Figure 2.—Detail of PPI diagramming in family camping units.

This method measures potential only, but actual pedestrian impact will vary in proportion with the measured potential.

Measuring this potential impact was only part of the problem. How this fits in with other variables in determining site carrying capacity was still unknown.

What happens when a recreation site deteriorates? Like a 10-ton bridge, when its load exceeds the limit, it falls down. The site falls down physically when it loses its vegetative cover and invites erosion. It also falls down esthetically when it loses its vegetative cover. Bare ground and erosion are not visually pleasing.

It was concluded that we could measure the loss of vegetative cover, and therefore measure the amount of site deterioration by measuring the amount of ground cover on the site. We call this the ground-cover index and define it as:

> The percent of that portion of the site, which is not surfaced or reinforced, and which is covered by ground-level vegetation, litter, moss, or rock.

This definition does not mean that site carrying capacity is reached when: (1) use reaches a certain amount; (2) certain soil characteristics are present; (3) slope is so much; and (4) site design is such and such.

This allowed all these factors to be tossed into a pot and stirred together so the answer that eventually surfaces and is skimmed off the top reflects the interaction of all these factors at each individual site.

The objective of the study was to measure the ecological factors, use, and design factors at each site and to see which combination of these factors resulted in the best correlation with ground-cover index.

DEVELOPMENT

All together, 38 factors or variables were measured. A multiple regression was run, using ground-cover index as the dependent variable and the remaining 37 variables as

the independent variables. The multiple regression indicated that:

1. Six independent variables made a highly significant contribution to the correlation with ground-cover index.
2. Six variables explained 85 percent of the variation in the correlation.
3. The addition of more variables to the correlation did not make a significant contribution to the correlation.

The six independent variables, in order of their importance, were:

1. Subsurface depth (thickness of B horizon, in inches).
2. PPI (the percent of the total area of the site that is not surfaced or reinforced and covered by anticipated pedestrian circulation).
3. Percent surface rock.
4. Substratum silt (percent silt in C horizon).
5. Percent slope.
6. Depth to water table, in inches.

The multiple regression also resulted in an equation using the six independent variables for estimating ground-cover index.

$$\text{Ground-Cover Index} = 81.28 + (-0.71A) + 0.21B + (-11.73C) + (-0.24D) + 0.82E - 0.19F$$

Where:
A = PPI
B = Depth of subsurface, in inches
C = Percent surface rock
D = Percent silt in substratum
E = Percent slope
F = Depth to water table, in inches

This equation has a standard error of estimate of 4.7, which means that the calculated ground-cover index will be within $\pm$ 4.7 of the actual ground-cover index 68 percent of the time.

In other words, by plugging the values for the five soils and slope variables and the PPI (or site design variable) into the equation, the amount of site deterioration can be predicted. This can be done for existing sites, or it can be used to predict what will happen on new sites planned for development or on sites being redesigned and reconstructed.

Obviously the dependent variable is important. How was a 75 ground-cover index selected? The key is the question, "What is unacceptable site deterioration?" Another way of stating it may be, "At what point does the balance between site conditions and use get out of control or beyond repair?"

After studying many sites and conferring with soils people, range people, timber people, everyone available, it was determined that the critical point is the set of conditions that allows significant soil movement. Very simply: if the ground is less than 75 percent covered with dead or living vegetative material, whether due to lack of moisture, compaction, or slope, you will have significant soil movement under use.

If you are starting with only 75 percent ground cover, you know that that particular set of conditions will not stand any additional impact.

So far, with only an administrative study as a foundation, we have a fairly crude tool. Even in its crude stage, its use is extremely important in design, and the future—with thorough research—may hold the key to enlightened recreation-resource management. We are using this tool now in the review of site selection, in the planning stage, and in design review in the site-design stages.

We required detailed soil surveys and reports on all development sites. We determine the PPI that these soils will support and then check for PPI on all design studies under consideration. Designs having excessive PPI ratings are not approved.

LOOKING AHEAD

What of the future? We know that these results were produced with limited study and should be used intelligently.

We know that we can increase carrying capacity by manipulating the key variables and even some variables that at this time are not indicated as being key. Crown closure of the overstory is one factor. Thinning to a point produces more ground-cover growth. We need to know how much this changes carrying capacity and at what point loss of litter from falling

leaves overtakes gain in growing ground cover.

All the variables can be discussed similarly. We need to know how much manipulation of variables is economically feasible.

Another factor of extreme importance for more detailed investigation is use. Any recreation use, no matter how slight, starts the ecological situation into a process of adjustment. We need to know how much use produces adjustment that is critical to the recreation product: how rapidly it will adjust under what conditions. It would, for instance, make a great deal of difference whether $10/unit/year in the manipulation of variables would hold adjustment to an acceptable stage, or $100/unit.

We may choose to accept $10/year but could not normally accept $100/year.

Since design was the number 2 variable in correlation importance and can be affected most easily, look to it first. Determine what PPI rating your design has and what PPI's your soils can stand. Find out how much you must reduce PPI in order to maintain the development.

If a minor adjustment is involved, you can probably handle it by minor design changes such as modification of trail system. Major adjustments may require redesign and a totally new development. It may be the cheapest thing you can do in the long run.

Let me repeat, *design* is the number 2 variable in site deterioration. As such, its relative success will have much effect on how well a development provides for the desired uses within the capability of the site to withstand them. It must then be as accurate a solution to the development problem as possible. It will not happen by accident. Design and layout of facilities must be a problem-solving process—and one that requires highly analytical and creative capabilities.

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THE ECONOMIC IMPACT OF RECREATION DEVELOPMENT: A SYNOPSIS

by WENDELL G. BEARDSLEY, *Economist, Intermountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, Ogden, Utah.*

ABSTRACT. Economic impacts per dollar of tourist expenditure have generally been found to be low compared to other economic sectors in local less-developed areas where recreation development is often proposed as a stimulus for economic growth. Tourism, however, can be economically important where potential or existing recreation attractions can encourage tourist spending in amounts large enough to offset these lower per-dollar impacts. In addition to definitions useful in interpreting the results of impact studies, findings from several investigations of local effects of recreation spending are discussed.

SPECULATION continues to best describe the process known as "estimating the economic impact" of recreation-area development. Local chambers of commerce and certain government public works agencies are noted for their optimistic views though some economists have been more cautious about the economic benefits of recreation development.

What is meant by "economic impact"? How large is the impact associated with recreation-area development and use? And where will such impacts be felt in the economy?

The answers are not all clear. However, we have the results of a few studies, completed in recent years, which provide clues to some of our questions. I will briefly outline the results of some of these studies and the factors that are relevant to the general problem of measuring economic impacts stemming from recreation.

Generally, such impacts have been found to be relatively small compared to impacts from other economic sectors. Their magnitude and some of the reasons given to explain their smallness are developed in the following pages. The scope of this paper is limited to exclude the literature dealing with the more general questions of local economic growth and the impact of public investments.

DEFINING IMPACT

To provide a base for further discussion, a few underlying concepts deserve mention. First, economic impact can be defined in at least two different ways, and it should be made clear which we are referring to. Often "impact" is used to mean "total spending," or "total business activity" created by the spending of new (outside) dollars in a particular area. Alternatively, it can refer to personal income that accrues to the area's residents in the form of wages, profits, rents, etc., because of the new spending. Obviously personal income is

only a portion of total business activity generated when new money is attracted to a particular local area.

Local communities, counties, states, and even whole regions of the Nation view recreation development as inducing economic growth of their area when visitors from outside bring new money into the area to purchase a recreation commodity. Critical elements in this concept are: (1) the recreation commodity must be exported from the relevant area to bring in new money, which can then recycle through the area's economy, producing employment, income, etc.; and (2) the relevant area must be clearly delineated—the perspective from which economic benefits are being viewed is of crucial importance.

For instance, recreation spending in Colorado by Nebraska tourists may result in net economic gains to the "Western" or "Mountain" region, to Colorado, to one or more Colorado counties, and to a number of Colorado communities. But it is a net economic loss to the "Plains" region, to Nebraska, and to certain Nebraska communities, or to some other area where the money would have been spent had Nebraskans not taken a Colorado vacation. The implication is that one should use extreme caution when interpreting the national benefits of a new park or recreation development *(Beardsley 1970)*. What applies at the local level may not apply if one assumes a national perspective.

BENEFITS

The logic of this argument applies as well to local economic benefits stemming from investment in construction of recreation facilities and the employment and income it may create. Real benefits may accrue to a local area or a region from public investment in a dam and recreation reservoir, for instance.

But against these benefits, assuming a national point of view, we might inquire what benefits are foregone in all other potential uses of the funds. The capital, labor, and resources expended in creating the reservoir might have found alternative (and, possibly, more productive) employment in recreation developments of other kinds or in other places or in provision of totally different public goods and services. Therefore real benefits of the reservoir to the Nation may be substantially less than those as viewed by the local area. From the larger point of view, the most important effect of the investment may be a redistribution of income favoring the local area in question—but possibly at the expense of other areas. Whether such redistribution is desirable or not is a socio-political question, beyond the scope of economic analysis.

This introduces some closely allied considerations—visitors' origins, spending habits, and length of stay at the study area. For example, certain kinds of recreation developments attract visitors from nearby metropolitan areas who visit the area on single-day trips and purchase in their home community nearly all of the equipment, food, etc. required for use of the area. Economic impacts in the local area (assuming it excludes the metropolitan areas) will be very slight compared to other kinds of recreation developments that might attract visitors who stay several days and make relatively high expenditures at or near the area in question.

WHERE THE MONEY GOES

Finally, it should be obvious that total expenditures by recreationists are not all net personal income to residents of the area or region. Some of the money received by local businesses leaves the area immediately as payment for imported goods and services (commonly referred to as "leakages"); some is respent within the area for local goods and services; and some accrues as income in the form of wages, profits, rents, and interest. A similar second round of spending for imports, local spending, and creation of local-area income is started from those original dollars respent in the local area.

This circular pattern of expenditures is, of course, the familiar multiplier process, begun by an original expenditure of new money in the local area, continued until all of it has leaked away. And, in general, the greater the proportion of goods and services for local consumption that are pro-

duced locally, as opposed to those that must be imported from outside the area (the more often basic dollars turn over before they leak away), the greater the multiplier effect is in increasing local income.

One counter-effect on leakage stemming from recreation development in the local area may be that residents reduce recreational visits to other areas in favor of visits to the development in their area. In effect, less recreation may be imported by area residents because it is being produced locally.

A rather peculiar aspect of economic impacts from recreation-related spending is their highly seasonal nature. Often, sustained local economic growth is hindered because nearly all spending is concentrated into a 2- or 3-month season; capital investments remain idle much of the year, and the seasonal labor force may leave the area, taking with it much of its wage and salary income for spending elsewhere. However, because of this seasonal pattern of outmigration of much of the labor force, school facilities, public utilities, and many costly public services are not required at the per-capita levels necessary for year-round residents.

What industries or sectors of the economy share the primary impact of recreation-related spending, and what is the magnitude of secondary impacts resulting from the respending process? Some insight can be obtained from studies of recreation expenditure effects on local communities.

Many of these studies have utilized input-output analysis to study the interrelations of the various "sectors" (businesses, governments, and households) of an area. Input-output analyses provide a means of estimating the dollar turnover resulting in all other sectors of the economy from additional expenditures in one or more particular sectors. However, input-output analysis is expensive in terms of the cost of data collection; if only a few broad sectors are used, collection and analysis of income and expenditure data will be less expensive than if many narrowly defined sectors are used. But if the "sectors" are not defined narrowly enough, the analysis may not be sensitive enough to accurately reflect the impact of a small additional expenditure in one sector.

Because of the rural and generally less-developed character of many local areas where recreation developments have been made or proposed, the impact on local business and associated creation of income from recreationists' spending has been relatively small, compared to other kinds of spending. As noted above, this is generally due to the high proportions of goods, services, capital, etc. that are imported to these areas. And again, an important source of leakage of money from the local area results when seasonal helps' summer earnings are saved and later spent outside the area.

SOME STUDIES

An excellent example is provided in a study of Teton County, Wyoming *(Rajender et al. 1967)*. There the total business activity stimulated by a dollar of expenditure in grocery and food stores (one of the main components of tourist spending, characterized by a high rate of leakage), was $1.12, including the original dollar, while for agricultural sales the figure was $1.70 (table 1). Personal income generated by a dollar in overall sales to tourists was $0.56 and in agriculture was $0.68.

Several industries were affected directly by tourist spending. These included eating places, auto services, food and retail stores, guest ranches, and lodging places. In these industries, *indirect* or secondary spending generated in the "multiplier process" was only 34 percent of total spending by tourists; the turnover of dollars from these industries in the local economy was very poor. However, in Teton County, the disadvantage of relative smallness of multiplier effects of tourists' spending is easily overcome by the large absolute levels of tourist expenditures. Fully two-thirds of all basic spending in the county was from tourists' expenditures, and this accounted for 59 percent of the $12.8 million in personal income received by local residents in 1964.

Because of the uniqueness of the county's recreational resources and the relative lack of opportunities for economic growth in

Table 1.—*Local impacts from sales in various economic sectors*

Area	Total business activity generated per dollar of sales			Personal income generated per dollar of sales			
	Tourist[1]	Agriculture	Grocery and food	Tourist[1]	Agriculture	Grocery and food	Timber production
Teton County, Wyoming	$1.46	$1.70	$1.12	$0.56	$0.68	$0.20	—
S. W. Wyoming	2.07	2.32	1.84	.31	.82	.42	—
Itasca County, Minn.	2.23[2]	2.04	1.18	.45[2]	.61	.13	$1.01
Reserve, New Mexico	—	1.66	1.13	—	—	—	—

[1]Average for all sales to tourists except as noted.
[2]Sales by resorts only.

other sectors, improvement of the economy may depend in large measure on further recreation development. For instance, it would be very interesting to know the economic effect on the county of the development, over the past several years, of a major ski resort near Jackson. The extreme seasonal fluctuation of employment and income may have been reduced, leading to greater integration of the economy.

Similar multipliers for total business activity were found in the Reserve New Mexico area *(Gray and Carruthers 1966)*. A dollar expended for food and groceries stimulated a total of only $1.13 in business activity in the local area—again including the first dollar. The corresponding figure for agriculture was $1.66.

The impact of spending by visitors to Flaming Gorge Reservoir on the economy of four southwestern Wyoming counties was likewise not large *(Kite and Schutz 1967)*. There, although a dollar of spending for food and groceries generated $1.84 in total business activity in the area, a dollar spent for agricultural products generated $2.32. Personal income generated by a dollar in sales to tourists was $0.31 and in agriculture was $0.82. The three sectors of the economy most affected by recreationists' expenditures were gasoline service stations, other retail businesses, and food and beverage establishments.

Total business activity generated in Itasca County, Minnesota, by a dollar in sales of groceries was $1.18 *(Hughes 1970)*. A dollar in sales of agricultural products created $2.04 in total spending. A dollar of spending in the resort sector created $2.23 in total business activity, but resulted in only $0.45 in personal income compared to $0.61 for agriculture and $1.01 in timber production, an activity using relatively high amounts of labor and low amounts of the products of other regions.

A similar figure, $0.49, was found for personal income generated per dollar of tourist spending in the Canyonlands National Park area of southeastern Utah *(Edminster and Harline 1962)*.

Even the establishment of Cape Cod National Seashore in 1961 was found in 1968 to have made little difference to jobs, population, and taxation. "The impact of the Seashore on major components of the economy has been small," except for land values, which have risen more steeply than could have been expected in the absence of the Seashore *(Herr 1969)*. Nearby private land values were found to have risen at 10.7 percent per year from 1960 to 1968, nearly triple that expected, based upon values on the rest of the Cape.

Similar larger-than-expected increases in private land values were reported around three reservoirs in Colorado *(Milliken and*

Mew 1969). Nearby private lands gained a net value increase of $5.16 million between 1946 and 1968, compared to that expected without the reservoirs.

IMPLICATIONS

Except for increases in land values near recreational developments, most evidence indicates relatively small effects on rural local economies from spending by recreationists. This is reflected in relatively low levels of secondary business activity and small income multipliers that result from the existing less-developed structure of these economies *(Hughes 1970)*. Unless secondary supporting businesses already exist or can be established, dollars from sales to recreationists leave the area relatively quickly as payment for imports of the products being sold; and local economies receive little benefit.

However, it should be recognized that recreation development may be the best possible means of stimulating the economy of certain local areas. If opportunities for industrial or agricultural development are lacking or limited, a recreation development attracting large amounts of tourist expenditures may easily overcome the disadvantage of the relative smallness of the associated multiplier effects, compared to other kinds of expenditures as illustrated by the Teton County study.

The results of studies such as these have important implications for recreation planning and local economic-development organizations. Development of the kinds of recreation attractions that will encourage visits year-round, longer visits, and higher levels of spending by tourists will increase the flow of basic expenditures and will result in economic improvement for such areas as these.

Recent trends toward integrated year-round resort communities offering a wide range of activities, accommodations, and attractions illustrate this concept. Jackson, Wyo., has added a major ski resort and side attractions such as several art galleries, tending to make it a year-long vacation spot as opposed to its past role in merely catering to summer visitors to Grand Teton National Park. Ketchum-Sun Valley, Idaho, on the other hand, has broadened its past image of a winter ski-resort community and has added a golf course and many summer homes in addition to more services for summer vacationers.

All of these trends should attract more spending the year round. The positive effects on the economies of these areas will be of considerable interest and may serve as a guide for development elsewhere.

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PRIVATE RECREATION ENTERPRISE ECONOMICS

by MALCOLM I. BEVINS, *Associate Resource Economist, Agricultural Experiment Station, University of Vermont, Burlington, Vt.*

ABSTRACT. Cash returns to recreation enterprise labor and management are low. Low returns are associated with poor location, small size, and short season. Land-value appreciation may offset low returns for some operators and explain why they stay in business. Profit maximization is not always the prime entrepreneurial goal: personal and noneconomic considerations or long-run capital gain may have an overriding effect. This situation could change if low returns were coupled with high property taxation over a prolonged period. Recreation researchers could add to existing knowledge by classifying all firms according to entrepreneurial goals.

PUBLIC LAW 88-29, passed by the U.S. Congress in 1963, called for a coordinated effort among all levels of government and private interests to assure adequate outdoor recreation resources for present and future generations. This law stimulated numerous studies of the economics of the private recreation firm. As a rule, these studies indicated relatively limited opportunity for financial success in the outdoor recreation business.

This report reviews a number of these studies and analyzes those factors associated with poor returns. Some of the goals of recreation entrepreneurs are reviewed, and the appropriateness of current financial-analysis techniques is evaluated.

PROFITABILITY OF THE RECREATION FIRM

Most economists agree on procedures for determining annual returns to labor and management. In simple terms, the commonly accepted procedure is to deduct actual cash expenses from gross income, and subtract from this amount an allowance for depreciation and return on capital investment. The residual is the return to labor and management. Further deduction of an allowance for unpaid family labor yields a residual that is called "return to the operator for his labor and management."

In general, returns to labor and management have been extremely low for firms engaged in providing outdoor recreation. Addressing a recreation workshop in Pennsylvania, Johnson *(1966)* said, "Probably three out of five recreation enterprises will fail financially, or go out of business for some other reason, within 5 years after they start. And, probably not more than half of the remainder will ever be really financially successful."

In a study of rural recreation enterprises in New England, Moore *(1964)* found that low returns to labor and management characterized a wide variety of recreational firms. His report was based on detailed case studies of 30 operations. The specific findings shed important light on enterprise profitability.

In a study of the private campground industry in Vermont, I found that 47 per-

cent of the campground operators were operating at a loss. To make matters worse, they had no return on their equity *(Bevins 1967)*. In another study of campground businesses in New York, Loomis and Wilkins *(1970)* concluded, "Incomes derived from the campground operations studied were extremely modest." Actually, net cash income less depreciation averaged only $83 for the season (before any allowance was made for interest on investment). The authors suggested that many campground operators need to look for nonmonetary returns to derive satisfaction from such operations.

Several factors are associated with income level in the outdoor recreation field. Among the more important are location of enterprise, scale of operation, business volume, length of season, and price level.

LOCATION OF ENTERPRISE

Johnson *(1962)* emphasized the importance of a good location: "Awesome scenery, salubrious climate, spectacular fishing, and other natural resources are economically sterile without the well-beaten path along which the necessary services can afford to cluster."

Location is critical when one is estimating demand for outdoor recreation. Any good text in business management stresses the importance of studying the business site in great detail before making a final selection. But many recreation entrepreneurs never take this critical step. They commonly start with a specific location and then attempt to select a recreation enterprise to fit it. In some cases, the property has been in the family for years. In other cases, it is purchased for personal pleasure rather than business potential. Quite possibly the owner has fond memories of the area as a boy and desires to "return home" to relive these memories. This is fine for personal satisfaction but makes poor business sense.

SCALE OF OPERATIONS AND BUSINESS VOLUME

Johnson *(1966)* concluded that two major causes for low returns from recreational ventures were small size of enterprise and too few customers. Citing a report prepared for the Appalachian Regional Commission by Robert R. Nathan Associates, Johnson (1968) noted that fewer than 6 percent of all recreation enterprises employ five or more persons on a year-round basis. Even during the peak of the season, fewer than 16 percent have five or more employees.

According to Loomis and Wilkins *(1970)*, "It is difficult to operate businesses profitably without sufficient volume over which to spread fixed costs." A campground swimming pool with the necessary filtration and cleaning equipment may cost $6,000. The cost for providing this type of recreation service is excessive for the operator who is small or fails to reach fairly high occupancy rates. Loomis and Wilkins correlated campground size with net cash income less depreciation. They found that, for the campgrounds studied, those with fewer than 100 sites averaged a minus $1,043; those with 100 to 199 sites, a minus $451; and those with 200 or more sites, a plus $1,818.

On the basis of occupancy, the New York study indicated that those firms with less than 40 percent occupancy had a net return of minus $2,273; those with 40 to 60 percent occupancy had a positive return of $758; and those with occupancy exceeding 60 percent had a positive return averaging $4,289.

LENGTH OF SEASON

The Bureau of Outdoor Recreation (1966) surveyed more than 2,000 financial institutions in a nationwide attitude study of lending practices. Bankers and lenders were asked if outdoor recreation enterprises were more risky than other business ventures and, if so, why. Nearly two-thirds of the respondents answered yes, and cited the limited length of season.

The major recreation market is the family unit. The family travels when children are on vacation from school, so most family recreation trips are limited to the summer months. One might legitimately question how a business firm can succeed when full-scale operations are restricted to 10 weeks of the year.

RECREATIONAL SERVICE PRICING

Loomis and Wilkins *(1970)* indicated that fees currently charged in New York campgrounds may be inadequate in terms of generating realistic levels of income. The entrepreneur who establishes price levels on the basis of operational cost is a rare person indeed. Observation indicates that pricing is more typically based on prevailing rates in the area than on operating costs.

Recreation is a service that the customer expects to receive at a minimal price. This attitude has been conditioned over the years where public facilities have been made available at less than full-cost pricing. At a recent congressional hearing to restore the Golden Eagle program (U.S. Congress 1970), testimony revealed that 73 percent of the respondents in a general population survey felt entrance fees at public areas should cover half or less of the total operational cost. Only 8 percent of the respondents felt that all costs should be borne by the recreationist.

Recreational services available at a subsidized rate impose serious restrictions on the private sector to price according to actual cost of operation. Recreation is a service for which the consumer will do comparison shopping if significant price differentials are apparent.

With low returns so prevalent in the outdoor recreation industry, we must question how the industry stays alive. The answer lies in an analysis of entrepreneurial goals.

ENTREPRENEURIAL FINANCIAL GOALS

Johnson *(1968)* classified recreation enterprises into three groups: the windfall or social operation, the supplemental operation, and the major enterprise.

He describes the windfall or social operation as a business in which the operator does not necessarily want to maximize cash returns from recreation. He will operate his facilities if returns cover cash costs because he believes in conservation, because members of the family want to partake in recreation, or because this is one way for a gregarious, retired person to keep active and have people around.

Johnson describes the supplemental enterprise as a business that provides work for unemployed or underemployed family labor. Cash returns usually are more important than in the first instance, but noncash benefits still can be of major importance. Where recreation is a major enterprise, all cash costs and most fixed costs associated with the operation must be covered.

Few data are available to indicate the relative importance of each of these classes of recreation business. However, it is apparent, after reviewing studies of enterprise net returns, that many firms may not look upon profit maximization as the primary enterprise goal. This creates a real problem for the operator who is vitally concerned with maximum net returns. He cannot use economic logic to predict the action of his competitors—a far different situation than exists in other commercial areas.

Uvacek and Schmedemann *(1968)* noted a similar situation in an analysis of Texas cattle operations. They divide cattlemen into three categories – traditional, transitional, and contemporary.

The traditional cattleman receives most of his income from livestock production. His actions are based upon rational farm management thinking. He buys and sells according to market conditions. His primary goal is profit maximization.

The transitional cattleman is primarily a "land stocker." His primary goal is to hold land. Grazing is really a side consideration. Profits may not be large; but to this person a cattle operation provides an enjoyable use of free time and makes some contribution to total family income.

The third type, the contemporary cattleman, owns a ranch for many reasons—recreation, prestige, health, a basic desire for land ownership, land value appreciation, or tax benefits.

The Texas study concluded that most transitional cattlemen and practically all contemporary cattlemen fail to increase or decrease business operations in response to price changes. Paradoxically, these cattlemen have an important effect on cattle

prices, yet their buy-and-sell decisions are not greatly affected by price. The traditional cattleman who attempts to analyze local market conditions and follow rational economic thinking in predicting market changes is frustrated when faced with such competition.

In analyzing these three types of cattlemen, Uvacek and Schmedemann maintained that under these circumstances it is unreasonable to assess all land costs against the cattle operation. Some value must be placed on the indirect benefits associated with the operation. Only by some revision of management-analysis techniques can we realistically project future growth of these types of operations.

Traditional labor income analysis rarely considers changing land values. Increases in land values are apparent only through a year-by-year comparative balance sheet, and then only if land values are adjusted annually.

In the Northeast, values of land with high recreational attributes are increasing phenomenally. Sinclair *(1969)* reports more than a fivefold increase in the weighted average price per acre of unimproved land sold in 31 typical Vermont towns between 1958 and 1968. Such an appreciation in land value can offset many years of low labor returns whether it be from farming, recreation, or other activity.

A smaller, though significant, increase in land values was noted in the Bureau of Outdoor Recreation report, Recreation Land Price Escalation *(1967)*. This report showed that land values are rising from 5 to 10 percent per year throughout the Nation.

RESEARCH IMPLICATIONS

If entrepreneurial goals are distinctly different, then the researcher who groups all firms together in an analysis of business operations is presenting a confused picture. This problem goes back to the initial collection of research data. At that time, he must ask the right questions so that each firm can be properly classified according to the operator's true goals. Firms must be so classified in any descriptive analysis of business operations if these analyses are to be meaningful. Following this procedure makes possible more realistic projections of recreational industry growth.

Negative returns to labor and management might be expected for the social entrepreneur (described by Johnson), or the contemporary entrepreneur (described by Uvacek and Schmedemann). A prolonged period of low returns might be possible where recreation is only a supplementary enterprise. Separation of these groups, in any analysis, permits a more direct focus on enterprises where recreation is the primary business activity or where profit maximization is the desired goal.

Extension workers and others who advise the recreation firm would benefit immeasurably from such a business analysis. Lenders would get a more realistic appraisal, and loan applications might be more favorably received. Lenders freely admit ignorance of the economics of the outdoor recreation enterprise (Bureau of Outdoor Recreation 1967). And this ignorance is magnified when researchers group firms with unlike goals together for analytical purposes.

And if we are to gain insight into the likely tenure of recreation business operations, we must look beyond returns to labor and management. We must build into our analytical framework consideration for increasing land values. This may have as much or more bearing on tenure than actual business profits.

IMPLICATIONS FOR EXTENSION WORK

The recreation firm adviser should first determine the true personal and business goals of the landowner before making specific recommendations. Johnson *(1966)* said, "If profits are not the major concern, we have no business trying to justify their success or flay their failure by use of economic measures."

Perhaps this means that we, as educators, should establish some values to reflect these noneconomic considerations and incorporate these values into formulas used to judge business decisions. Time-tested de-

cision-making procedures should not be dropped. Every business operator, regardless of his motivation, should at least be aware of how his operation deviates from the optimum situation dictated by rigid economic analysis. Ideas that might be discarded for the entrepreneur whose primary goal is profit maximization might not be discarded for the entrepreneur with other goals.

Consider, for example, the retired plumber who fondly remembers bobsledding as a boy and wishes to establish a commercial bobsled run on his property. His prime motivation is personal recreation. Perhaps he should not be discouraged from such an operation even though market analysis indicates that the odds for success are low. He must mentally equate his total personal gains and financial losses in arriving at a final decision.

All business operators should be made aware of the break-even concept and its application. Campground operators might use this tool to project cost-revenue data and to determine the occupancy level at which revenue from campsites will cover specific expenses. From such an analysis, proper decisions might be made concerning an economically sound rate structure. If an operator chooses to deviate from such a rate structure, he does so in full recognition of the economic consequences.

Capital budgeting should become common practice in evaluating alternatives. Recognition of the time value and opportunity cost of money must be impressed upon individuals making financial decisions, whether they be personal- or business-motivated. We should not fear the use of sophisticated and complex tools in educational programs even though some of our clients may hold other values higher than profit maximization.

Time and motion study and work simplification techniques are needed in the recreation field. Every effort should be made to reduce labor requirements associated with daily operations. This type of analysis would be appropriate for all classes of entrepreneurs, irrespective of motivation. No one likes to work harder than is absolutely necessary. Substantial improvements in work methods have been accomplished through time and motion studies in agriculture and forestry. These same techniques need to be applied in the recreation field—in both public and private sectors.

PROPERTY TAXATION A MAJOR PROBLEM

In the Northeast, property taxation is a major emerging problem that could have a pronounced impact on all private recreation development. The problem is acute in areas where the fair market value of land is rising unchecked in response to an urban interest in a rural retreat.

In Vermont I studied taxation of youth camps and attitudes of operators *(Bevins 1970)*. In 1966 only 15 percent of the youth-camp operators felt that they might be taxed out of business. By 1969 the number had risen to 38 percent. The youth-camp industry is a victim of circumstances. Land and water resources, which are absolutely necessary to effectively operate a youth camp, carry a high value for seasonal-home development. The camp operator will receive a significant capital gain if and when property is sold for seasonal homes. But some operators would prefer to continue a camp operation and would do so if property taxes were realistically alined with camp revenue.

A parallel situation may be emerging with other recreational firms. It would indeed be unfortunate to see all types of private outdoor recreation resources sold for seasonal-home development. Yet such a situation could be triggered by unchecked increases in property taxation.

THE SHORTER WORK WEEK A MAJOR OPPORTUNITY

On the brighter side of the picture, the recent movement toward the 10-hour work day and 4-day work week is encouraging for the outdoor recreation enterprise. If this transition should become widespread, recreation enterprises located relatively near Northeastern urban population centers might be greatly affected. The extra day off might provide a much-needed addi-

tion to weekday business volume—currently a severely limiting factor to business success. Moore *(1964)* noted that in New England, except for summer camps and vacation farms, weekend business accounted for 70 to 90 percent of total weekly receipts.

If the 10-hour day becomes acceptable, we might very logically move to a situation where each of two crews works 3 days a week, 10 hours a day, This would make economic sense, as industrial firms could use their equipment far more efficiently.

Consider the impact that this might have upon the recreation industry. What does this mean in terms of primary residence? Is it not conceivable that the seasonal home might become the permanent home if the urban apartment is needed only two nights a week? Recreation planners should seriously consider this possibility if urban pressures continue to increase and more industries reduce the length of the work week.

PROFITS TO THE INNOVATOR

The innovator in American industry is usually well rewarded. In the recreation field, this opportunity is not diminished in the least. An innovator must have imagination, a superior knowledge of people, their interests and attitudes, and a constant awareness of changing technology.

Accurate prediction of changing recreation interests is not easy. People change, and their interests change over time. Consider the gross inaccuracy had we projected 1930 recreation interests into the 1970's on the basis of population increases alone. Our failure to recognize man's increasing mobility would have led to the construction of an oversupply of large country inns, many of which would be abandoned today. A similar overbuilding would have occurred had we developed youth camps on the basis of population projections alone.

One cannot project recreation demand too far with any degree of reliability. Specific activity interest may come, go, and later return again. Witness the changing interest in cross-country skiing. At one time this was a highly popular activity. Later it was overshadowed by downhill skiing, and now it is again an expanding activity.

The innovating entrepreneur is a gambler in a sense. He won't be satisfied adhering to the security of a currently acceptable recreation mode. He will question his customers thoroughly to determine their true recreation interests and their unsatisfied goals. He will critically observe their actions to determine how he might modify his operation to yield greater customer satisfaction. He will experiment with new ideas. Some of these ideas will prove worthless, but his ultimate success may hinge upon the early development of just one ingenious idea. The lightweight boat was developed in response to man's interest in mobility. The quick-release ski binding was the outcome of man's interest in increased safety.

The aggressive entrepreneur will study our mathematical projections of demographic data and apply his personal knowledge of people, their interests, and attitudes. He will conceive a development program that will yield far greater returns than the operation planned in accordance with a stereotyped set of recommendations. Entrepreneurial gain is still very much a matter of individual initiative and perseverance.

SUMMARY & DISCUSSION

As a rule the returns to the labor and management input in private outdoor recreation enterprises are low. Improper location is a major factor associated with low returns. Other factors include insufficient size of operation and too short a business season.

We cannot assume that these limiting factors and low returns will discourage landowners from entering and continuing in the private outdoor recreation field. In many instances the decision to operate an outdoor recreation enterprise is more related to personal and noneconomic con-

sideration than to profit maximization. If, however, low returns are coupled with high property taxation over a prolonged period, the ultimate effect may be an overbalancing of these personal and noneconomic considerations and an end to recreation business activities.

The traditional methods of measuring enterprise profitability are unrealistic unless we consider land-value appreciation. This factor may be a far greater determinant of enterprise tenure than actual cash returns to labor and management.

Any realistic projection of the role of private enterprise in outdoor recreation must consider (1) cash enterprise returns, (2) land value appreciation, (3) land taxation, and (4) noneconomic entrepreneurial goals. Failure to consider any one of these factors could lead to a grossly inaccurate projection.

Outdoor recreation researchers can clear some muddy waters if they will properly classify outdoor recreation enterprises according to entrepreneurial goals. Research results so classified will be far more useful to field advisers, bankers, and others than any information now available. Recreation field advisers must tailor their advice to the product of rational economic analysis coupled with full consideration of personal landowner desires.

A major problem of the recreation firm is underutilization of facilities on weekdays. Improvement may be on the horizon if the 4-day work week should become common. At some point in the future, a 3-day work week with two crews may become common. Such action would have a profound impact on the outdoor recreation industry.

The private outdoor recreation firm has an important role to play in the years ahead. The highest degree of success will accrue to the entrepreneur who uses ingenuity and imagination and becomes an innovator among recreation firms. Researchers and field advisers are challenged to help guide the private sector to minimize mistakes in judgment and to maximize benefits, both monetary and nonmonetary.

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AN ANALYSIS OF ENVIRONMENTAL QUALITY RANKING SYSTEMS

by JULIUS GY. FABOS, *Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst, Mass.*
This paper was prepared while the author served as National Science Faculty Fellow in the School of Natural Resources, University of Michigan, 1970-71. The author acknowledges the helpful advice and encouragement of Dr. Gunter Schramm.

ABSTRACT. A review and analysis of the quantitative ranking systems that have been developed during the past decade for measuring environmental quality.

DURING THE PAST decade many quantitative ranking systems have been developed for measuring environmental quality. This upsurge of quality quantification has paralleled the renewed interest in environmental quality. Most of the systems were designed to estimate the qualitative values of the natural or cultural landscapes.[1] Others were designed to test cultural preferences of people or their behavior in relation to complexity in the environment. Many disciplines have contributed to the development of the systems, ranging from landscape architects through geographers, psychologists, and economists to engineers. Some systems have been designed by interdisciplinary teams.

In this paper I aim to bring together information about the art of environmental quality-ranking systems; to analyze them against an appropriate set of criteria; and to identify areas where improvement and further research are needed.

Some personal biases and value judgments are inherent in such a study, and a completely objective evaluation would be impossible because the available literature on the systems is incomplete. I will not try to provide a detailed analysis of all systems reviewed, rather to provide only brief abstract interpretations of them.

This study focuses on the analysis of those ranking systems that deal with landscape qualities, but it does not exclude urban scapes such as residential neighborhoods. Analysis of this kind is not available at this time; however, the upsurge of the numerous systems warrants a continuing analysis and evaluation of them. Their values ought to be questioned, and the techniques must be improved, if we aim to estimate landscape qualities and predict changes resulting from the activities of men.

GENERAL BACKGROUND

The norms used in evaluating environmental qualities are believed to be influenced by two sets of factors: The first is cultural and has long historical roots. This can be analyzed with relative certainty. The second is psychological. For instance, human beings react to complex physical environments differently than to simple, monotone surroundings; and often there are large deviations between individuals.[2] Research on these factors is very limited at present.

Historical Factors

The 19th century concern for romantic landscape quality has had a major influence on present landscape values in the United States. Coming mainly from England, the interest in romantic landscape spread rapidly sometime after 1830. Tree-planting societies were beautifying and laying out village commons, cemeteries, and local academies in the picturesque romantic style.[3] Today the fenceless suburbias with winding roads and large setbacks provide the same parklike quality developed during the 19th century romantic-landscape movement.

Thoreau, Olmsted, and their contemporaries have greatly influenced our values towards nature. They preached the need for harmony between man and nature, and they later had great impact on the 19th century movement to protect the "monumental beauty" of the West.[4] Olmsted and others helped to bring about the preservation of some unique landscapes in several parts of the U. S., and their values have influenced the attitudes of the National Park Service.[5]

Charles Eliot articulated well the landscape values at the turn of the century. In his plan for the Boston metropolitan area, he proposed the protection of estuaries, spaces on the ocean front, island and bay areas, and wild forests on the outskirts. He proposed squares, playgrounds, and parks throughout the city.[6] The sum of these amenities meant environmental quality to him.

Conventional Non-quantitative Evaluation of Landscapes

In addition to natural and cultural factors, landscape architects and land planners traditionally have evaluated and mapped the visual qualities of landscapes and urban scapes. Through drawings and writing they have described the attributes of such variables as spatial enclosure, form, edge configurations (shoreline), dominant features, views, vistas, and contrast.

During the past two decades, descriptions of the sequential experiences have intensified.[7] In a recent study, Burton Litton[8] described in detail the visual variables generally accepted as norms by the design profession. According to Litton, the quality of the scenic resource depends on distance of view, the observer's position, form, spatial definition, light, and sequence. The landscape composition is based on the panoramic quality type and quality of features in the landscape, enclosure on the side and or by canopy. In addition, he described the detail and ephemeral components of the landscape.

The variables used in conventional landscape evaluations are the basis for most of the qualitative ranking systems. The major difference between conventional evaluation and ranking systems seems to be that the latter quantify areas with various characteristics and often place number values on the variables.

Recent Factors in the Upsurge of Quantitative Environmental Ranking Systems:

The first factors are the increased wealth and mobility during the post World War II era, which escalated the demand on the natural resources. For instance, Wyckoff[9] compared the urban land demand per person before and after 1950 and found that the 18 percent population growth in the Springfield, Mass., area increased urban land use by 136 percent between 1951 and 1965. The recreation demand escalated similarly, though detailed study is not available on recreation land use increase per person. By the 1960's recreation demand was so significant that it created national attention. The Outdoor Recreation Review Commission[10] was set up to prepare a nationwide study of the recreation demand and problems.

The need for natural stock resources (coal, oil, gas, etc.) escalated in the same manner. The problems of strip-mining have received wide attention, and evaluation of their effect on the landscape has begun.[11] Our society is increasingly aware of environmental concerns and the costs of resource utilization and has recently undertaken surveys of the combined effects of resource uses such as electric power, which is dependent on both stock resources and land for power lines and stations, and flow

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resources (water for hydroelectric power). Abrahamson[12] estimated a twelvefold increase of electric consumption between 1950 and 2000. The impact of such an increase on the Nation's landscape might be extremely significant.

Another factor for ranking systems design is the increasing role of the U.S. and other industrialized nations in land-use through large-scale planning, management, and policy formulation.[13] These governmental activities are directly responsible for several ranking systems discussed in this study.[14]

A third factor is the availability of sophisticated data-analysis techniques and hardware. For instance Steinitz et. al. developed computer graphic techniques appropriate for regional landscape analysis.[15] The symap version of that technique has been adopted by the State of New York to make an inventory of the natural resources of the entire State. Disciplines interested in the environment are discovering statistical and other mathematical tools essential for quantitative evaluations.[16]

A fourth factor is that the number of disciplines making environmental quality oriented studies and research have skyrocketed during the past decade. The directory of *Behavior & Environmental Design* by the Research & Design Institute lists 34 disciplines and 290 professionals and organizations conducting behavior and environmental research. The directory listing increased by over 70 percent in 4 years.[17] Furthermore, several students of environmental quality concerns are interested in ranking systems that can be used to predict consequences of urbanization of the landscape.[18] Predictive models are widely used by physical and social scientists, who often use normative variables and measures for evaluation, such as the G.N.P., to predict the change of life standards.[19]

The last factor is described by Michael Novak[20] in his recent book *The Experience of Nothingness*. He argues that our cultural norms are such that the demand for "objectivity" and "pragmatism" becomes more and more important and that we ought to have the "hard facts and figures" to influence successfully the decision-making. The planning and design professions, through designing quality ranking systems, are able to provide the facts and figures our culture demands for decision-making.

ANALYSIS PROCEDURE

The ranking systems analyzed here were grouped into three major categories based on their scale characteristics and overall purpose. Each of the systems within each category is described briefly, and the categories are analyzed against each of the eight criteria.

Major Categories of Environmental Quality-Ranking Systems

I. Quality-ranking systems to evaluate resources for policy planning. These systems are providing gross appreciation of the environmental quality of a large region such as the North Atlantic region of the United States. The category is further subdivided into the following groups:
   A. Systems on professional planning and design norms to evaluate landscape qualities.
   B. Systems to evaluate peoples' preferences towards regional landscape characteristics and complexities.

II. Quality-ranking systems to evaluate resources for the purpose of planning and action on interstate, state, and subregional scale. These systems can be used to influence physical decisions on the land; for instance, the selection and allocation of land for various kinds of recreation and conservation uses of a region. The subcategories are:
   A. Systems evaluating landscape qualities (1) for landscape development and protection type decisions; (2) for highway planning decisions. This subgroup is different, because highway oriented landscapes are mostly viewed in motion.
   B. Systems to evaluate peoples' preferences of landscape characteristics.

III. Quality-ranking systems for the purpose of evaluating the landscape for a single use such as camping or boating. These techniques are used mainly to

evaluate sites from among which the more appropriate sites are selected for development.

Format for the Description of the Ranking Systems

Where information is available, the ranking system is abstracted as follows. The agencies and disciplines who conducted the study are identified. The situation that provided the impetus for the study is described. Then the factors and variables used in the study are summarized, and finally the procedure of the study is briefly presented.

Criteria for Analysis

The major categories are analyzed against each of the eight criteria described below. In instances, reference is made to the individual ranking systems to emphasize optimum use or negligence of the criteria under analysis. It is not suggested, however, that each ranking system ought to satisfy each of the criteria developed here.

1. The system is designed to evaluate the entire landscape continuum. – The landscape continuum has three components. First is the unique landscape. It includes those natural or cultural landscapes that have the characteristics of one of a kind within a study area such as a region, or it has some superb quality characteristics of one kind or another. Agreement about what constituted the unique landscape was not too difficult in the past. No one refutes the unique quality of the Grand Canyon, for instance. The evaluation of uniqueness, however, is getting more difficult in places where the unique attribute serves only a special interest group; for example, wilderness areas for wild river canoeing.

The second component of the landscape continuum is the opposite of uniqueness, often referred to as misfit.[21] Misfits are results of human activity, and they can have a significant regional impact. The problem remains, however, how to define "misfit" or "bad quality." For instance, billboards are eyesores to conservationists and beautiful art to the graphic artists.

The third component of the landscape is the largest and the most difficult to deal with. It includes all landscapes that are neither unique nor misfits. Several of the ranking systems reviewed here are developed to evaluate exclusively these in-between landscapes, which have the attributes of what Ervin Zube[22] describes as "ubiquities or regionally pervasive values." He suggests for this type of landscape assessments and measurements to focus on the "critical landscape attributes."

2. The permanent or immutable and the changeable or mutable landscape attributes are evaluated separately.—The permanent landscape attributes are those that cannot be changed easily or significantly by man. They include land form characteristics, major water bodies, and climatic characteristics. The changeable landscape attributes are all those that are influenced or determined by human activity or the lack of it such as farm, urban, or wilderness landscape characteristics.

3. The factors and variables used are appropriate to the scale and purpose of the ranking system. – A ranking system designed to evaluate a large region for the purpose of formulating a land-use policy may necessitate an entirely different set of factors and variables than a system prepared to evaluate a camping site. For instance, the evaluation of the shoreline quality of a small lake within a campsite area is essential for the latter, but would be totally useless for a land-use policy formulation for a state or a large region.

4. The system is designed to be used universally, given that scale and purpose are basically constant.—The design of a system demands skills and time. Once a system is developed, it should be applicable anywhere where similar conditions and needs for evaluation arise. For instance, a shoreline quality for swimming is equally important in Europe and in America.

5. The ranking system can be reproduced by others.—Scientists have accepted this criteria for a long time and for good reasons. People having similar skills or coming from the same discipline as those who developed a system should be able to re-

produce and evaluate it. Several of the ranking systems published to date are extremely inadequate when analyzed against this criteria.

6. The system can be used to predict changes of quality as result of human activity.—Two kinds of changes need to be predicted. First is the decreased amount or degree in the environmental quality. Second is the increase of it. In some instances a study might indicate that certain proposed changes would have neutral effects on the existing quality.

7. The quantitative tools and techniques used are appropriate for the ranking system.—Several systems use statistical techniques, computers, and other tools such as a photometer to measure tonal values. There may be instances where the ranking system could be improved by using appropriate tools and techniques. In other cases, tools and techniques are used unnecessarily or the process is poorly documented so that objective evaluation by others is impossible. Mark Twain[23] once commented, "He uses statistics as a drunk uses a lamppost; not for light but for support." Similar problems often occur with the use of the computer.

8. The system has the ability to reduce or eliminate conflicts in the decision-making process.—The most obvious factors that influence environmental quality are political, economic, technical, or technological. Special-interest groups might constitute an added factor in the decision making process. The designers of the systems should be aware of these factors at the outset and should develop the ranking system in such a way that it communicates the measured values effectively, thus reducing the conflicts and boundaries between the influencing factors. For instance, alternative route proposals of electric power lines or highways might have very different effects on a given landscape. A quality ranking system might clarify the degrees of negative changes for each of the possible alternative routes.

DESCRIPTION AND ANALYSIS OF EXISTING OR PROPOSED SYSTEMS

I. For Policy Planning

Nine systems have been classified. Five of them were designed to evaluate national or regional landscape qualities, and four deal with peoples' preferences.

A. Systems to evaluate landscape qualities.—The first attempt to rank regional landscape resource qualities was made in the 1930's by the staff of the National Park Service.[24] The purpose of the study was to evaluate the Nation's vacation resources. Natural factors provided the dominant determinants for the ranking. The quality of topography, water, climate, (immutable resources) and the plant life (mutable resource) were described. Criteria were developed for summer, winter, and year-round vacation lands. The three types of vacation regions were identified and mapped.

The second national effort to rank recreational resources was made by the Outdoor Recreation Resource Review Commission (ORRRC)[25] as part of their assessment of the Nation's outdoor recreation needs, around 1960. ORRRC proposed a system for classifying recreation resources into six use classes: high-density recreation areas, general outdoor recreation areas, natural environmental areas, outstanding natural areas, primitive areas, and historic and cultural sites.

A set of natural-physical requirements, in combination with proximity to population, determines the use class. Landscape attractiveness is a major factor for determining each class. For instance, natural environment class areas ought to have "varied and interesting land forms, lakes, streams, flora and fauna within attractive natural settings."

The outstanding natural class area includes "individual areas of remarkable natural wonder, high scenic splendor, or features of scenic importance." A ranking system determining what constitutes these qualities was not developed by the Commission.

The ORRRC study could well be developed further and could be applied to the three types of vacation land developed by the National Park Service.

Ian McHarg[26] with his students at the University of Pennsylvania, developed a ranking system, on a river-basin scale. A matrix was developed, in which the full compatibility (as opposed to incompatibility) of a given land use (industrial, forestry) was measured against the natural determinants (climate, slope). The use consequences range from good, fair, and poor to bad. The matrix suggests that those areas where the use consequences are good are the high-quality environments.

The development of two other ranking systems was made possible by the Water Resources Planning Act of 1965. Under the guidelines of the Water Resources Council established by the Act, "framework" type studies have been conducted for each of the nineteen water resource regions of the U.S. One of the four objectives of the Council is to achieve environmental quality. Planners in two of the regional study groups, Upper Mississippi and North Atlantic, found it necessary to design ranking systems for evaluating the existing environmental qualities.

The Upper Mississippi system was developed by Philip H. Lewis, Jr., and Associates, Landscape Architects,[27] to provide an assessment of the aesthetic and cultural values for this region. A system was developed to evaluate 13 natural and cultural factors. Each of the factors was further subdivided into variables. A resource-value point system was assigned intuitively to each of the 120 variables, ranging from 1 to 20. The variables included such items as high points, caves, virgin stands, and old mills. The inventory technique and criteria for the point system were not described. The environmental quality of an area was assumed to be determined by the total number of points it received. Application of this ranking system to the huge Upper Mississippi region is unclear.

The ranking system for the North Atlantic Region was designed by Research Planning & Design Associates, Inc., a consulting firm in Amherst, Mass.,[28] to evaluate the regionally pervasive[29] visual and cultural environment of the 167,000 square miles of the region. The permanent and changeable landscapes were evaluated separately.

The permanent landscape was classified into five landscape series, ranging from mountains to flat lands. Each landscape series was evaluated for the quality of contrast, spatial sequence, and water variables, and was ranked as high, medial, or low quality.

The changeable landscapes were classified into eight units, determined by intensity of use, ranging from center-city unit to forest wildland landscape unit. The landscape units were evaluated on the same three-level ranking of high, medial, and low. The major variables for the unit evaluations were variety and diversity within the use patterns.

Finally a system was devised to combine the permanent and changeable visual landscape values into one existing landscape value, using the same three-level ranking.

B. Systems to evaluate people's preferences towards regional landscape characteristics and complexities.—Three landscape preference systems for evaluation were developed at the Department of Landscape Architecture, University of Massachusetts,[30] to validate the hypothesis of the ranking system for the North Atlantic Region. The studies were initiated and directed by Professor Zube and were prepared by four landscape architect students, Albert, Burns, Rundell, and Halverson.[31]

The hypothesis tested by the students was that the quality of land form, water, and contrast (the variables of the permanent landscape) and variety, diversity (the variables of the changeable landscape) are essential components and determinants of overall landscape quality.

Albert used color slides of New England landscapes and tested and evaluated the responses of university students, using tachistoscopic projection.

Burns and Rundell used a set of 10 photo-montages. The pattern in the middle ground was developed in five combinations of field and forest. The horizon line was either mountains or rolling hills. A random sample test on the adult population of

Amherst was conducted, using the paired comparison format.

The study of Halverson was similar to that of Burns and Rundell, using line drawings in place of photo-montages.

The studies showed that greater variety of pattern and changes in topography were preferred over little variety of pattern and flatter landscapes.

A unique study was made by Joachim Wohlwill[32] on human reaction to complexity in the physical environment. Wohlwill's purpose was to "determine whether relationships between stimulus complexity on the one hand, and interest and preference on the other, as previously determined for artificial stimuli in the laboratory, could be generalized to stimulus domains involving ready made stimuli." He used two classes of stimuli—environmental and artistic —as examples of such domains.

A 7-point scale of complexity was established by obtaining judges' ratings of amount of variation present in environmental and art pictures. The exploratory behavior, (the number of times the subject chose to expose each slide briefly) and the subjects' preference (evaluation ratings on a 7-point scale), was tested and analyzed through regression. The preference for complexity increased from levels 1 to 4; then, as complexity further increased to level 7, the preference decreased. This type of studies could have influence on planning policy formulation.

Analysis of Category I

The ranking systems of this category deal with regionally pervasive landscapes only, and do not rate the unique landscapes nor the misfit landscapes. Zube justifies this exclusion as follows: "The search for uniqueness and to a lesser extent the concern for misfits tends to focus on discrete sites, on specific well defined segments of the landscape."[33]

It is true in most cases, however, that a unique quality might extend far beyond a site. For instance, the wilderness type landscape of northern Maine or the embayed rocky cliffs of the Maine shoreline constitute unique attributes on a subregional scale within the North Atlantic Region. Without much effort, the highest and lowest values could be built into the ranking systems on this scale. Hence the entire landscape continuum could be evaluated.

Permanent and changeable landscape attributes are separated in the Potomac and the North Atlantic Region systems. In the matrix of the Potomac system, the major emphasis is based on the differentiation between natural determinants and compatibility of land uses, while in the North Atlantic Region study between the landscape systems (permanent) and the landscape units (changeable), landscape is emphasized. Both systems evaluate successfully those resources that need protection or preservation and those that are modified constantly by human activity and can be improved at will.

The appropriateness of the factors and variables used in these appears to be optimum for this category, except for the Upper Mississippi system. The evaluation of 13 factors and 120 variables within a region that consists of several hundred square miles seems to present a monumental and unnecessary task. Variables such as an old mill or a small waterfall might have significance for a specific local planning effort, but add little to the environmental quality of a huge region.

Unfortunately, for neither of the three systems—National Park Service, Potomac, and Upper Mississippi—are the analytical and ranking procedures presented in sufficient detail to permit wider adaption or evaluation by others. Furthermore, they could not easily be reproduced by students of quality ranking systems.

An evaluation of the category I ranking systems against criterion six (predictability) leads to the conclusion that no one system in this group was designed for predicting quality changes as a result of human activity. Probably the system designed for the North Atlantic Region could be developed further for such predictive purposes because it evaluates the changeable landscape attributes separately. If the variety and diversity change of the proposed landscape pattern are known, the new combined landscape quality could be estimated because the value of the permanent landscape remains constant.

Quantitative techniques for the purpose of evaluation were used only in the systems that were designed to evaluate people preferences. For each of these systems, simple statistical techniques were used to set up the experiment and to evaluate them. The explanations are simple and adequate, and the test could be made easily to validate them.

The last criterion deals with the ability of the systems to reduce conflicts in the decision-making process. To satisfy this criterion, the systems ought to be presented in such a way that nonprofessionals can understand them. No one of the systems in category I was found to fully satisfy this criterion. The ORRRC and the NAR studies are the most convincing, while the Mississippi system is the most complex. It is presented in a 600-page report, and it communicates poorly even to other professionals.

II. For Physical Planning and Action

The greatest number of ranking systems was found in this category. Seven of the 11 systems were designed to evaluate regional landscape qualities, and the other four dealt with preferences and perceptions of people.

A. Systems to evaluate landscape qualities

1. For landscape development and protection type decisions.—The state-wide recreation study in Wisconsin gave the impetus for the development of an environmental quality ranking system by Philip H. Lewis, Jr.[34] This study was one of the first efforts to rank environmental qualities on a regional scale. The purpose was to evaluate "the state wide pattern of resources values" for recreation. Lewis inventoried and evaluated on the basis of 11 natural and cultural factors, which were further subdivided into 220 resource variables. The concentration of these resources in so-called "environmental corridors" provided the high quality statewide pattern of resource values.

A landscape resource evaluation for Nantucket Island, Massachusetts, was prepared by Ervin Zube and the author in 1966.[35] The landscape evaluation was a portion of a comprehensive natural resources inventory, done in collaboration with the University of Massachusetts Extension Service and the State Department of Natural Resources, who gave the impetus for the study. The team evaluated three resource factors: biophysical resources, natural factors, and landscape types and values. Eight areas were flagged for protection where concentration of high-quality landscape resources occurred. Furthermore, high-quality, fragile, or scarce resources were ranked as unique for preservation. The unique landscapes included the heath, dune, and salt-marsh landscapes, and five areas of high points that provided panoramic views of the island and the ocean. In addition, the land-form attributes were evaluated and ranked into four categories. This ranking system later influenced the system developed for the North Atlantic Region.

A resource evaluation system for the Department of Parks of Staten Island, New York, was designed by Ian McHarg and Juneja, landscape architects.[36] The purpose of the study was to evaluate potential land uses for the island, based on the intrinsic values. They described and interpreted 32 ecological factors (land features, aquifers, etc.). Ranking criteria were developed for each of the ecological factors, ranging from maximum to minimum. A system of "phenomena ranking" placed a value on each resource factor, having highest, medium, low, or lowest value. Based on this evaluation, each resource was assigned for a compatible land use.

An environmental quality-ranking system was recently developed by Handley, Jordan, and Patterson[37] of the Bureau of Outdoor Recreation's Northeast Regional Office. The system was an attempt to quantify levels of environmental quality in a segment of the total possible spectrum. The primary purpose of the system was to provide a basis for environmental quality evaluations of a single area under varying conditions. The intent was to predict consequences by varying the individual environmental factors through different combinations of time, intensity, and input interrelationships.

The portion of the environmental spectrum covered by the system is indicated by the use of eight broad categories: resident population, community resources, water resources, land forms, leisure resources, vegetative resources, wildlife resources, and historical/archaeological concerns. Each of these categories was further broken down into those factors believed to contribute the most to its meaning.[38] Numerical values assigned to each factor produced a positive base value. This base value was subsequently modified by application of weighting factors (multipliers) to reflect incremental value not solely attributable to the degree to which a category's factors are present. Negative factors—air, water, visual, audio, and crowding—were used to reflect the value limitations these sources impose on the derivable benefits of the base values.

The next system described here was developed in England. A landscape evaluation research project for East Sussex County was prepared by K. D. Fines[39] at the East Sussex County Planning Department. The aim of the study was to design a method of landscape and townscape evaluation. At the start, a world wide scale of the natural and cultural values was devised, ranging from unsightly, undistinguished, pleasant, distinguished, and superb, to spectacular. To eliminate personal bias in landscape appreciation, a representative group of 45 persons was selected to rank and evaluate color photographs of landscape and townscape views of the entire landscape continuum. The result of the view evaluations was converted to land-surface values of landscape types, features, and viewpoints. The landscape of East Sussex was evaluated and measured against the landscape value profile of England. Application of the technique was briefly discussed. It was suggested to be used as a guide to the formulation of urban expansion policy and in the section of routes and sites in open country. The report demonstrated the application of the technique to predict the change of landscape values created by a 400 kV supergrid transmission line on alternative routes. The evaluation system would also be used for protecting valuable landscapes against what Fines describes as "the process of landscape erosion."[40]

2. For highway planning decisions.—The following two systems of category II (evaluation of landscape qualities) were designed to measure highway-oriented landscapes. Before development of these systems, several planners were interested to describe the components of a quality highway.[41] Others were interested to study the driver's experience in motion and record the visual sequence.[42]

The first quantitative ranking system of highway landscapes that is known to the author was developed by Frederic O. Sargent[43] at the Vermont Resources Research Center. Sargent, a resource economist, evaluated highway scenery by ranking two components—distance and variety—and then adjusting this total rating with reference to depth, breadth, intermittency of the view, and eyesores if any. Distance was rated from 1 to 5; the greater the distance, the higher the rating. Variety was also rated from 1 to 5; the greater the variety, the higher the rating. The distance and variety ratings were added to provide the total rating at one observation point. A series of ratings every ½ mile characterized the scenic quality of a road. The system was designed to (1) facilitate justifying scenic road designations, (2) facilitate location of scenic turnouts on highways, and (3) determine the need for scenic access on a given road.

A highway aesthetics study for the U.S. Department of Transportation was conducted by Professor Hornbeck & Associates,[44] at the Department of Landscape Architecture at Harvard since 1965. The purpose of the study is to develop devices to increase the planning of scenic qualities of highways. The aesthetic factors were identified as visual inputs in the study. They included edge quality, degree and quality of enclosure, object dominance by contrast, size and nearness, the quality of object diversity, and the attributes of the visual alignment. The visual impacts of each input (aesthetic factors) were rated and measured against behavioral outputs (speed control, orientation) of the driver.

B. Systems to evaluate peoples' preferences. —Four studies dealt with peoples' preferences for natural and cultural landscape characteristics. The first of them was done by George Peterson[45] at the Department of Civil Engineering at Northwestern University in 1965. The purpose of the study was to analyze quantitatively the perception of the visual appearance of residential neighborhoods. Nine variables were assumed to contribute to the visual appearance of residential neighborhoods: preference, greenery, open space, age, expensiveness, safety, privacy, beauty, and closeness to nature. A hypothesized model was constructed. Preference to variables was tested and rated on a scale for each variable by projecting 23 slides to 140 individuals. Finally the hypothesis was tested through regression analysis. It was concluded that the most significant dimension for preference of visual appearance "appears to be the general physical quality, which is strongly reflected by the perceived age of the neighborhood."[46]

The next system was an analysis of landscape development by Peter Jacobs and Douglas Way,[47] landscape architects. The purpose of the study was to evaluate the ability of various landscapes to visually absorb land-use activities. The three variables were vegetation density, topographic closure, and visual complexity. A ranking scale was devised, ranging from 0 to 9, "the degree to which undeveloped landscapes differed visually from the identical landscapes with selected activity uses introduced into them."[48] Thirty subjects were tested, using the paired comparison format. The authors concluded that greater vegetation density and topographic closure absorb visual complexity better than little vegetation density and flat topography.

A predictive model for natural landscape preferences was prepared at The Northeastern Forest Experiment Station, USDA Forest Service, by Shafer, Hamilton, and Schmidt,[49] an inter-disciplinary research team at the Station's Syracuse unit. The purpose of the study was "to identify what quantitative variables in photographs of landscapes were significantly related to public preference for those landscapes."[50] Ten variables were identified to describe landscape zones such as, sky zone, vegetation zone, and stream zone in the photographs. Four additional variables identified landscape zone dimensions. They were perimeter, interior, area, and horizontal end squares of various items in the 8 x 10 photographs, overlayed by ¼-inch grid for analysis of pictures. Landscape zone and dimension variables were read into the computer. Tonal variables were determined by the use of photometer and were added. A model was formulated by correlating 46 x 46 total possible variables, and a matrix was computed to describe the landscapes in the photograph.

The next step was the landscape preference test "to see if there was a significant relationship between quantitative items in the photographs of a landscape and the preference score of that landscape."[51] To evaluate preferences, 250 respondents examined 20 packets of 5 photographs each. A landscape preference score from 1 to 5 was obtained from the sample interviews, and a multiple-regression analysis was used to evaluate the dependent variable preference score. The model was quite successful. "In five of the six field tests, the predicted and observed ranks of the landscape pictures showed agreement."[52]

The last study in this category dealt with a system of landscape dimensions developed by K. H. Craik,[53] a psychologist, as a continuation of the forest-landscape description study by Litton.[54] The aim of Craik's study was to improve landscape inventory methods and landscape resource evaluation. First Craik collaborated with Litton in developing a landscape rating scale that contained 10 factors, including observer's position, extent of view, and enclosure; and contained 34 dimensions such as the observer is looking down upon or looking up toward the scene. In addition, he developed a graphic landscape typology, consisting of 10 schematic landscape forms.

A series of test panels, consisting in total of 250 people, were drawn from forestry and conservation students and faculty, landscape architecture students and faculty, U.S. Forest Service personnel, and general university students. To appraise the reliability of the landscape rating scales and

graphic landscape typology, the observers judged 50 landscape scenes, rating the scenes on each landscape dimension and assigning each scene to the most appropriate graphic type. The result of the study showed substantial consensus among panels and impressive agreement in the way they employed the landscape rating scales. A detailed explanation of the statistics is included in the report. Preliminary tests of the relationship of the landscape dimensions and types to aesthetic appeal served to illustrate the scientific application of the techniques.

Analysis of Category II

In this category the ranking system by Fines, the study of East Sussex, and in a lesser degree the systems of the Bureau of Outdoor Recreation and the Staten Island Study, evaluated the entire landscape continuum. One aspect of Fines' system is especially remarkable: he appreciated the entire spectrum of the world natural-cultural qualities, ranging from unsightly to spectacular. Then he placed his region into the context of a world-wide scale of values.

The Nantucket study placed great emphasis on unique qualities in addition to pervasive landscape values. Parts of the unique Nantucket landscapes are nationally significant, such as the heath vegetation; others, for example the sand-dune landscapes, have only island-wide significance.

The ranking system should indicate the level of significance of uniqueness. Sargent and especially the BOR systems placed great emphasis on the evaluation of the negative factors or misfits. The BOR listed explicitly the components of negative factors, and the weighting of the values seemed to estimate the environmental problems well.

The second criterion, the separation of permanent and changeable landscapes, was not developed in any of the systems discussed in this category. The systems for Staten Island, Wisconsin, Nantucket, and East Sussex County recognized some of these factors but did not go far enough in separating them.

The factors and variables used in this category are appropriate for the scale and purpose of the systems. However, in some cases the number of variables selected are either too few or too many.

The two extreme cases were the Wisconsin study, which dealt with 220 variables, which seems to be unmanageable and suggests too great an expenditure for inventory. On the other hand, Sargent's classification system, using only a few variables, suggests an oversimplified ranking system.

The more significant problem is that the majority of the variables used were selected intuitively, so that their scoring values were arbitrary. This analysis suggests two important actions to improve the state of the art of the ranking systems: first, the systems should include primarily those variables that are already substantiated by the eight preference studies discussed; second, the designers of preference studies should review the factors and variables used in the ranking systems discussed and should evaluate peoples' preferences to those landscape characteristics.

The universality and the reproducibility of the ranking systems developed by the BOR, Shafer et. al., and Craik are well explained and well described. The three studies that do not fully satisfy the above criteria are: First, the Staten Island system, which describes the phenomena ranking through qualitative terms and also through names of location such as the phenomena rank for the water features and scenic values "the Narrows, Kill Van Kull, and Arthur Kill." The later ranking is meaningful only for those who conducted the study or know the island. Second, the study "highway esthetics." The 1968 report reviewed is extremely complex and difficult to understand. Third, the study "visual analysis of landscape development," because it does not explain adequately the testing method; hence it would be hard to reproduce.

The criterion that the ranking system should be useful for predicting changes was included at the outset in 3 of the 11 systems. They were the ranking systems for East Sussex, BOR, and Shafer's predictive model for natural landscape preferences. These attempts are very encouraging. It is

hoped that they will set the example for future ranking systems.

Computer and statistical tests were used primarily in the systems for preference tests. These tests undoubtedly demand statistical techniques. Among the nonpreference systems only the East Sussex study used statistics. Shafer used a photometer to measure tonal values in photographs. Tools of this kind certainly have great potential, but the analysis of their value is difficult, because the testing of the technique is limited at this time.

The last criterion deals with the systems' ability to reduce conflict in the decision-making process. It was suggested earlier that complex studies and professional jargons limit communication. One case study in this category, the Nantucket study, has proved to be successful in communicating the landscape values to the decision-makers. As a result of that study, over 25 percent of the Island's land has been permanently protected, where the majority of the protected areas consist of fragile landscapes.

III. For A Single Use

Four studies are grouped in this category, each based on professional planning and design norms to evaluate qualities. Not one of these systems was designed to evaluate the preferences of people.

A quality ranking system was adopted by Chubb[55] at the Michigan Recreation Resource Planning Division, from a PhD dissertation by Carlton Van Doren[56] at Michigan State University. The purpose of the system was to develop attraction and capacity indices for boating and for other recreational uses. A case study for boating attraction was developed. Twelve variables were identified, among them size, access, fishing, and scenic qualities. A scoring schedule with maximum score was established for each variable. The recreational quality of the attributes of each variable (e.g. size of lake: small 0, medium 10, large 20 points) determined the number of points it received. The score numbers of the variables were totaled to provide the attraction index for the boating site.

An evaluation of forest campground sites was done by Allison and Leighton,[57] foresters at the University of New Hampshire. The purpose of the study was to develop a numerical rating system for campground site selection. Eight physical factors were evaluated: water, topography, potable water, vegetation, natural attractions, vista, forest pests, wildlife, and climate. These factors were further subdivided into 22 variables. (e.g. size and quality of water) Three socio-economic factors – the location, economic-business management, and proposed campground facilities – were expressed by 20 variables (e.g., access to major highway). The condition of variables was ranked from excellent to good, fair, and poor. A point value was assigned to each condition within each of the 42 variables. The point score of the physical factors and socio-economic factors were totaled separately for rating the campground sites as excellent, good, fair, or poor.

An appraisal system for recreation potentials was developed by the USDA Soil Conservation Service (SCS).[58] The purpose of the study was to develop a systematic approach to evaluate the natural resources of the area for potential future outdoor recreation developments by SCS and county recreation planners. Ten key elements were used in evaluating recreational potential for each of 12 standard kinds of outdoor recreation areas (e.g., camping grounds, fishing waters, golf courses). The key elements were climate, scenery, natural areas, historic areas, soils, water, wildlife, size and distribution of population, proximity and access ownership, and land-use pattern. A rating system was devised; and a number from 0 to 10 was assigned to each key element to indicate the degree of excellence represented by the key element for a particular kind of recreation development.[59] A multiplier was assigned for each element within each kind of recreation development to represent the weighted importance of a particular key element. Then a score number was obtained as the result of multiplying the rating number of a particular element with the weighted multiplier. Finally the sum of the scores of all the key elements gave the numerical score for a kind of recreational development.

A method for quantitative comparison of some aesthetic factors among rivers was developed by Luna Leopold.[60] The purpose of his study was to quantify the non-monetary values of various potential hydropower dam sites in river valleys. Leopold described 3 sets of factors; 14 physical factors such as river width, depth, basin area, deposition, and erosion; 14 biologic and water-quality factors, among them water color, amount and type of algae, river fauna, and land flora; and finally 18 human use and interest factors, for instance trash, accessibility, vistas, land use, and misfits. An evaluation number from 1 to 5 was assigned to each of the 42 factors. Then a uniqueness ratio was calculated, which is the number of sites being evaluated divided by a given number for a given factor. For example "if a site factor is one among twelve of the same category, the site shares this characteristic with eleven others. It is unique in the ratio 1 to 12 or its uniqueness ratio is 1 : 12 (.08). If no other site shares the same category position, then the site has a uniqueness ratio of 1 : 1 (1.0). The uniqueness is thus defined on a scale of 0 to 1.0."[61] Finally the *total* uniqueness ratio for a site was determined by adding the ratios of all 46 factors. Leopold applied this quantitative quality evaluation on 12 sites in Idaho. Hells Canyon of the Snake River was shown to be unique and comparable only to Grand Canyon of the Colorado River.

Analysis of Category III

The landscape continuum, as defined in this study, was recognized within this category only by Leopold. He developed the most sophisticated method to evaluate the uniqueness quality and the negative components in the landscape. The Michigan system for boating attraction by Chubb dealt with one aspect of negative factors by deducting points for water pollution.

The separation of permanent and changeable landscape attributes was also well done by Leopold. One set of factors he developed, the physical factors, represent clearly the permanent attributes. The system for evaluating forest campgrounds by Allison and Leighton lists the biological factors under the physical factors, which could be easily separated; then the system would satisfy this criterion.

The analysis of the appropriateness of factors and variables used suggests that some factors listed for the forest campground—for instance, distance from urban population and climatic factors—should be considered at a higher level, such as in the systems discussed in category II. The number and the kind of variables evaluated in the SCS study (10) and in the Michigan boating attraction system (12) seem to be limited to describing and evaluating the quality of a site. The variables used by Leopold seem better for site level evaluation.

Each of the four systems in this category could be applied universally and reproduced easily. They all are well written and explained. The Leopold system would create some difficulty to reproduce because it is somewhat complex.

Only Leopold's system could be used to predict outcome of changes, though it was designed to measure the relative values of sites as they exist today.

These systems of category III did not demand any sophisticated tools or techniques. Those that were used seem to be appropriate for these systems.

The last criterion deals with the analysis of the system's ability to reduce or eliminate conflicts in the decision-making process. The purpose of the Leopold study was exactly to deal with this problem—to quantify the non-monetary values, which might have great and long-range social values, (the environmental quality uniqueness of Hells Canyon) not yet recognized to the same degree by contemporary economic evaluation techniques.

DISCUSSION

During the 1960's an impressive number of environmental quality-ranking systems have been designed. The ranking systems appear to have several values for estimating environmental qualities on various levels, ranging from site level to regional and national scale. Some aspects of the quality variables have been substantiated by preference studies, and psychological studies have been used to explore the relationship

between environmental complexity and stimuli. Several of the systems have attempted to predict outcome of proposed actions.

The ability to predict has become extremely important because the environmental uncertainties are rapidly being increased by our technological actions. Some of the systems have been useful for limiting the conflicts in our complex public decision-making process. The greatest potential value of the ranking systems, however, is that they may be used to create new social norms for greater appreciation of environmental qualities. The systems can be used to create a needed and useful myth that emphasizes quality rather than quantity.

This analysis also suggests several problems and needs for making the existing ranking systems more valuable. One of the most significant problems is that the majority of the systems do not deal with the entire landscape continuum from the large to the small and from the unsightly to the spectacular. The majority of the systems are designed with single purpose to evaluate a limited area, and they are not placed into the context of the scale of landscape and its values.

A system such as Fines' should be expanded, substantiated, and adopted internationally as a frame for all value systems. The designers of quality-ranking systems should evaluate those developed for the sciences. For instance the classification system of the plant kingdom is remarkable as it proceeds with order, class downward, providing more and more information and detail down to plant species and varieties. Fines' and the NAR[62] systems have some attributes that could serve as framework for a similar system for landscape classification and evaluation.

Another general problem with the present system is that the majority of the values placed on environmental factors and variables are intuitive. Many more preference studies are needed to provide a base for a set of normative values to be used in the ranking systems in place of intuitive values. In addition, the increase of preference studies would give impetus to scientists to conduct additional studies on environmental complexity problems, and to develop social indicators.

Furthermore, the separation of mutable and immutable values is absolutely essential in each ranking system. Evaluation of changes or prediction as result of changes by human activity is not possible until the permanent and changeable attributes and their values are separately recognized.

The selection of the proper number and appropriate type of variables for qualitative evaluations has been less than optimum in several of the systems analyzed. One of the reasons for this problem seems to be that the designers of the systems do not alter the variables while developing a ranking system for a larger region.

These problems suggest at least two alternative solutions: people who are designing quantitative ranking systems without sufficient training should collaborate with people who already have the needed tools, or should obtain the necessary tools. It is also suspected that some quantitatively trained people developing quality-ranking systems are lacking the visual awareness of designers such as those who are trained in landscape architecture.

Reference Notes

1. The term "cultural landscape" is used here to describe any or all physical influences of man upon the land resulting from his construction of buildings or from continuous use of land as in farming.

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13. Eckbo, Dean, Austin & Williams. STATE OF HAWAII LAND USE DISTRICTS AND REGULATION REVIEW. Hawaii Land Use Comn. Dep. Planning and Econ. Develop., Honolulu, 1970. Hawaii is the first State in the U.S. that has explicit land-use zoning for the entire State.

U.S. Water Resources Council. NATIONAL WATER RESOURCES. Superintendent of Documents, U.S. Government Printing Office, Washington, D. C., 1968. The council's recommendation to plan for environmental quality gave the impetus for the development of quality-ranking systems for the North Atlantic Region and the Upper Mississippi River Basin.

14. Additional ranking systems stimulated by governmental activities are: ORRRC study, Potomac River Basin's ranking by McHarg, environmental corridor study for Wisconsin by Lewis, Nantucket study by Zube & Fabos, SCS staff study The Guide to Making Appraisal, and Chubb's system analysis approach in Michigan.

15. Steinits & Rogers Associates, Cambridge, Mass., and Enviromedia, Inc., Minneapolis, Minn. NATURAL RESOURCE PROTECTION STUDY. 1970. Ranks input of resource data and produces composite computer maps with tones.

16. Almost half of the ranking systems reviewed in this study applied statistics or used computer for evaluation.

17. Research and Design Institute, 1969 Directory. BEHAVIOR AND ENVIRONMENTAL DESIGN. Res. & Design Inst., REDE, Providence, R. I., 1969.

18. Among the studies reviewed here, the systems of the Bureau of Outdoor Recreation, Shafer's and Fein's were designed at the outset to predict quality changes in the landscape.

19. It is believed by this author that the economists were successful in creating a myth using the G.N.P. to evaluate life standards and that G.N.P. is not an accurate measure for the quality of life —yet it indicates it. Contemporary planning and design norms for quality evaluation are just as valid as or better than the norms of the economists.

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28. Research Planning & Design Associates, Inc. NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY, APPENDIX N: VISUAL & CULTURAL ENVIRONMENT. Nov. 1970, pp. 16-24. Three principals of the firm, Ervin Zube, Paul Procopio, and the author of this paper, assisted by Robert Brush, landscape architects, were developing this system in 1967. The ranking system is now being further developed for the State of Vermont by Terrence Boyle, principal, and Peter Olin, assistant of Research Planning & Design Associates, Inc.

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30. Ibid, pp. 24-26.

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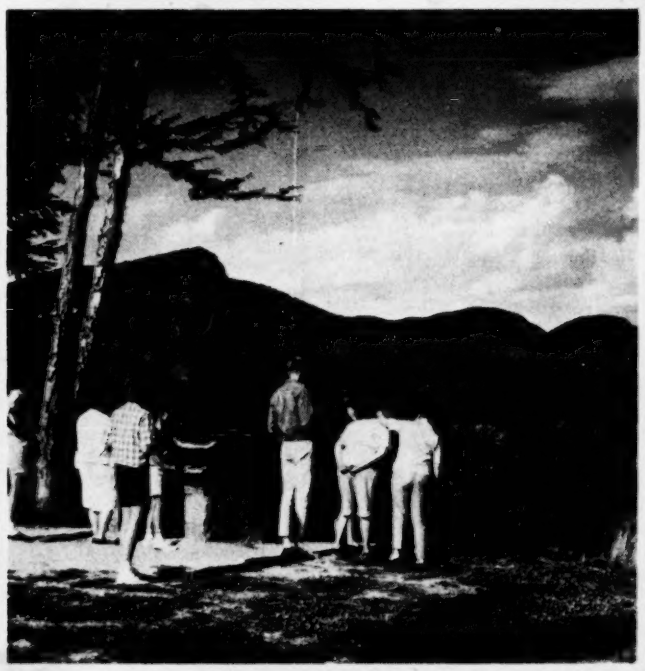
Managing the Recreation Resource



PRESERVING NATURE IN FORESTED WILDERNESS AREAS AND NATIONAL PARKS

by MIRON L. HEINSELMAN, *Principal Plant Ecologist, North Central Forest Experiment Station, USDA Forest Service, St. Paul, Minn.*

ABSTRACT. The natural forest ecosystems of some of our national parks and wilderness areas are endangered by subtle ecological changes, primarily because we have failed to understand the dynamic nature of these ecosystems and because protection programs frequently have excluded the very factors that produce natural plant and animal communities. Maintaining natural ecosystems requires that the elemental forces of the past, such as fire, must still prevail.

This paper is based on an article published in NATIONAL PARKS AND CONSERVATION MAGAZINE, September 1970, and is reprinted with permission from NATIONAL PARKS & CONSERVATION MAGAZINE, which assumes no responsibility for its distribution other than through the magazine.

THE INSPIRATIONAL, scientific, and educational values of our National Parks and Wilderness Areas depend heavily on our success in preserving nature. But do you know that the natural forest ecosystems of some of our most cherished areas are endangered by subtle ecological changes? This is so primarily because we have failed to consider the dynamic character of primeval ecosystems, and because "protection" programs frequently exclude the very factors that produce natural plant and animal communities.

This problem is part of our present ecological crisis, but it is a special problem, often unrecognized even by conservationists and environmentalists. We have assumed that preservation is assured by prohibiting logging, grazing, mining, agriculture, hunting, or trapping, and by protecting the forests from fire, insects, and disease. Sometimes this is so, where a climax ecosystem exists. But as modern biology and ecology reveal the life histories of plants and animals and the intricate interactions between environmental factors and plant and animal communities, we see more and more broken links in natural ecosystems.

Fire is perhaps the single most important environmental factor being altered—it was essential in the reproduction of the primeval forests of many areas, for example the lodgepole pine forests of Yellowstone National Park and the Bob Marshall Wilderness; the jack, red, and white pine forests, and the aspen-birch forests of the Boundary Waters Canoe Area; and even the giant Sequoia forests of Sequoia-Kings Canyon National Parks.

What then does the "preservation of nature" really mean for forested wilderness? I think it means we must focus on restoring

the total natural environment – physical factors as well as plant and animal communities. But let me give you a more complete picture of the ecological problems, and possible new program directions.

ECOLOGICAL PROBLEMS

Natural forest communities exhibit a remarkable adjustment to local geology, soils, topography, and climate. Each plant species occurs on soils to which it is adapted, and within altitudinal and latitudinal zones that meet its temperature and moisture needs. Many forests also exhibit a layered structure, in which certain species occupy the upper canopy, while others form an understory. There is an adjustment of one plant species to another in the competition for moisture, nutrients, heat, and light.

Yet seldom does a single forest community hold permanent possession of any given site. For if we look around we see one community here, while not far away a very different one may occupy an otherwise identical situation. Perhaps in one situation the forest is an ancient and uneven-aged assemblage of Englemann spruce and subalpine fir, with scattered old lodgepole pines; next door is a dog-hair thicket of young lodgepoles–with fire-blackened snags standing in their midst. What we are witnessing is proof of a dramatic vegetation change related to a powerful natural environmental factor–fire.

Studies in forest ecology in the last 60 years have taught us much about such vegetation changes, and some of this knowledge has already become part of the lore of wilderness enthusiasts and amateur naturalists. But even professional land managers have more to learn before the full meaning of this natural drama becomes recognized in Wilderness and Park programs, because we still ignore some of the implications.

Forests are born of change, and they die through change as well. Plant and animal communities are dynamic–ever-changing, ever-growing, maturing, and dying–to be succeeded by some other community adapted to new circumstances. And yet there is a fascinating order to these changes, for similar sequences of events are repeated again and again.

The concepts of "pioneer" and "late successional" or "climax" communities are helpful in understanding vegetational history. A "pioneer" forest is composed of trees and other plants capable of occupying denuded terrain, such as recent glacial moraines and exposed bedrock, or ground laid bare by fires, windstorms, avalanches, and erosion. The trees that form pioneer stands are sun-loving and well adapted to growing in the open, but often poorly adapted to growing beneath a forest canopy.

Pioneers also possess special adaptations for reproducing on open lands, or following forest fires or other catastrophes. Some have light seeds easily transported by the wind–such as the aspens, birches, willows, and certain pines and spruces. Some are capable of sprouting from the root collar, or from underground stems or roots. The oaks, aspens, birches, many other deciduous trees, and coast redwood possess one or both of these abilities. Only under unusual circumstances does fire destroy the ability of such trees to quickly repopulate burned land.

HOW FIRE HELPS

One of the most fascinating adaptations of pioneer species to fire is the persistent closed-cone habit of lodgepole pine, jack pine, and certain other conifers. These trees are readily killed by forest fires–either crown fires or severe ground fires. But their cones are borne high in the crown, and remain attached and closed for years, storing huge quantities of viable seed.

When fires sweep through the forest, they kill the trees and scorch both crowns and cones. But temperatures inside the cones usually do not reach lethal levels, and the resins that seal the cone scales are melted. After the fire the cones open and release the seeds, which fall upon ashes and exposed soil, temporarily freed of competing plants.

These are ideal conditions for the young conifers, and most of our forests of lodgepole pine, jack pine, and black spruce originated in this manner. Next time you admire the vast forests of lodgepole pine in Yellowstone Park or the Bob Marshall Wilderness, or the jack pine and black

spruce forests of the Superior-Quetico canoe country, remember, these beautiful forests are the products of past fires.

And these fires did *not* destroy the soil, nor rob the land of its fertility. In fact, in northern regions and cool mountains there is a gradual accumulation of needles, leaves, mosses, and rotting wood during the life of a forest that actually *ties up* essential plant nutrients and covers the soil with such a thick layer of humus that tiny conifer seedlings have difficulty getting established. Fires consume this organic mantle, bare the mineral-soil seedbeds, and release the accumulated mineral elements.

Thus fires can actually rejuvenate a forest by replacing an old decadent stand with a new vigorous one. This is precisely what has happened ever since the Ice Age in the lodgepole forests of the Rockies, and throughout the range of jack pine and black spruce in the Lake States and the boreal forests of Canada and Alaska.

Red (Norway) pine and white pine in the Lake States and the Northeast, and ponderosa pine, sugar pine, larch, western white pine, Douglas-fir, and giant Sequoia in the West also reproduce after fires, but by a different mechanism. Because of their thick bark and long branchless trunks, these trees are fire-resistant and can survive severe ground fires. But they lack the closed-cone habit, and shed their seed and drop their cones soon after the cones mature. Furthermore, in several species good seed years occur only at intervals of 2 to 5 years or more.

CONDITIONS FOR REGENERATION

In presettlement times ground fires often crept through forests of these species, eliminating the undergrowth of competing shade-tolerant trees and shrubs that would otherwise invade such forests. Such ground fires also retarded the accumulation of organic matter and fuels. Eventually, however, a fire hot enough to kill many of the old trees occurred, setting up conditions for regeneration. The area was partially freed of tree cover; standing snags and scattered groves or individual trees provided partial shade; mineral-soil seedbeds were available; and competition for nutrients and moisture was greatly reduced. The scattered veterans provided seed in good seed years, and the denuded area gradually seeded in to the original species. A new and nearly even-aged forest was formed, perhaps interrupted by groves of unburned or fire-scarred older trees.

Thus arose the famous pineries of the old North Woods, the great ponderosa pine, larch, Douglas-fir, and Sequoia forests of the West, and the pineries of the Old South. Fire scars or "catfaces" on old trees still tell of this history. And the ages of many of our present forests can still be related to the tree-ring records of fire scars on these veterans. Thus many of the most magnificent conifer forests in our National Parks and Wilderness Areas owe their origin and present composition to past fires.

In presettlement times, fires were caused both by lightning and by the accidental or deliberate firing of forests by the Indians. Early man, in fact, is thought to have burned the forests of North America in at least some regions for perhaps 10,000 years. But lightning was (and still is) a sufficient cause of fire in many regions; and if man failed to ignite a flammable forest, sooner or later lightning produced the same result. This can be inferred from the evolutionary adaptations to fire of many plants (for example, the closed-cone habit of jack pine and lodgepole pine), and from records of ancient charcoal in peat bogs, lake sediments, and glacial deposits.

The number of years between major fires in any one area must have varied greatly. Our best record of this today is the tree-ring record on fire-scarred trees, and the ages of whole forests known to have originated following fires. Research in the Boundary Waters Canoe Area in Minnesota indicates that severe fires resulting in the destruction of the old forest and regeneration of a new stand usually recurred on any one site at intervals of 50 to 300 years.

But occasionally the interval was as short as 10 to 30 years, and in the West the intervals in some areas may have been longer than 300 years. The interval tends to be characteristic of particular geographic regions, and related to the typical age of

post-fire forests at maturity. Light ground fires also burned through many stands at shorter intervals, but these fires usually brought in little successful tree reproduction.

"SUCCESSION"

In the absence of fires, insect outbreaks, or severe windstorms, most pioneer forests are gradually replaced by shade-tolerant species. This process is known as "succession." We once thought its ultimate product was a regional "climax" vegetation, capable of reproducing itself indefinitely on the same site, without the intervention of major disturbances such as fire or windstorms.

This view of forest succession is no longer held by most ecologists, because the actual history of forest stands is usually far more complex, and often punctuated by intermittent disturbances. Even the shade-tolerant "climax" species are replaced under some circumstances, and the environment itself may change through peat accumulation, climatic shifts, erosion, changes in animal populations, and other events. Some of the trees that are capable of growing beneath the pines and other pioneers are the maples, eastern and western hemlock, northern white-cedar and western redcedar, red, white, and Englemann spruce, and several true firs. They are characterized by an ability to grow under the conditions associated with deep shade, and to become established on thick layers of humus.

As forests grow old, trees gradually die and fall to the ground. The age at which this occurs varies greatly by species, local growing conditions, geographic region, and many chance factors. Generally however, jack pine, lodgepole pine, and aspen trees are relatively short-lived—most do not live more than 100 to 250 years. The white pines, red pine, ponderosa pine, Douglas-fir, and western larch may live 300 to 500 years or more. And the Sequoia, redwood, western hemlock, western redcedar, and some other western conifers may live 800 to several thousand years. These differences in longevity also influence stand composition.

Many forests contain mixtures of shade-tolerant trees, some of which reproduce successfully in small openings created by the death of individuals. Forests of this kind tend to develop a many-aged structure if they persist for long periods without serious disturbance by fires, insects, or windstorms. Examples are the hemlock, cedar, spruce, and true fir forests of the Cascades, Olympics, and Coast Range in the Pacific Northwest; the Englemann spruce and subalpine fir forests of the Rockies; the maple, birch, beech, and hemlock forests of the Lake States and the Northeast; and the balsam-fir, spruce, and cedar forests of the New England mountains, the Adirondacks, and the northern Lake States.

But even these more stable forests are often ravaged by windstorms or insect epidemics. The spruce budworm, for example, has recently killed most of the balsam fir and much of the white spruce over millions of acres in eastern Canada, New England, and Minnesota. Fortunately, these forests also have a mechanism for replacing themselves. Thousands of tiny balsam seedlings are usually present on the ground, and many are not killed by the budworm. Thus when the budworm has consumed an old forest, the next generation of young firs is waiting to replace it.

In the Rockies, vast areas of Englemann spruce are sometimes decimated by bark beetles. This has happened in some of our Wilderness Areas in the past few decades. But usually enough seed trees escape; and these, together with a few small seedlings not killed by the beetles, initiate a new stand. Insect-ravaged forests such as these may look desolate for a decade or more; but then the new forest appears, and life begins anew as it has for untold generations.

Fires can denude vast areas for long periods if they entirely consume forests of conifers lacking the closed-cone adaptation, or if they reburn young stands before seed-bearing age is reached. Lodgepole pine, jack pine, and black spruce begin to bear seed between 10 and 20 years of age, but many conifers begin much later—often age 50 or more. Such reburns are not too common, however; and usually scattered individuals or groves of mature trees escape.

But changes in forest composition are to be expected after such fires, and the rebirth process may take several decades.

WHAT IS "VIRGIN"

The foregoing discussion suggests that the usual concept of a "virgin forest" is misleading. Many people think of such forests as only the old and venerable communities of large trees, and regard them as permanent legacies from the past, that somehow escaped the ravages of fire, insects, and disease. We also require, and rightly so, that these forests never have been logged or cleared by man. Forests resulting from logging, clearing, burning, or similar disturbances are called "second growth," and are considered inferior. But the "virgin forest" must be redefined in the light of modern ecology, because we know that many of our finest examples are really the products of presettlement fires, windstorms, insect outbreaks, and similar natural disturbances.

A better definition of a virgin forest is that it simply be the product of natural environmental factors and ecological processes, as opposed to a forest resulting from logging, land-clearing, herbiciding, planting, or similar disturbances by man. By this definition a virgin forest can be either young or old, composed of large species or small, well-stocked or nearly open, and magnificent or homely. This is a far more ecologically defensible concept, for it admits all truly natural landscapes, whether the forests originated centuries ago, or just last year following a fire or insect epidemic. We must then recognize that the "second growth" on a new burn today may become the "venerable" old forest in our great-grandchildren's time!

Many species of wildlife are adapted to early successional plant communities, while others are characteristic of mature forests. Both kinds have a place in Wilderness Areas today if they were present in the primeval ecosystems. Species characteristic of burns, open areas, shrub communities, and early successional stages include the white-tailed and mule deer, elk, ruffed grouse, sharptailed grouse, hares, foxes, coyotes, bears, beaver, and many more. Some of these animals were really more at home on the edges of disturbed areas than in the great open areas, but they nevertheless were associated with new successions. Species that seem to have been more abundant in mature conifer forests include the pine marten, certain squirrels, and several birds. Other species, such as the moose, timber wolf, cougar, and woodland caribou ranged widely between mature forests and new successional stages and are difficult to pigeonhole.

THE ELEMENTAL FORCES

The implications of natural history for wilderness and national park preservation programs are far-reaching. For if we are serious about maintaining the natural ecosystems of these areas, then clearly the elemental forces of the past must still prevail. And when we consider past and present resource "protection" policies, we see important deficiencies.

What have we been doing? Perhaps most significant, we have attempted to control forest fires for 50 years or more; in most areas we are now quite successful. Yet, by so doing we have sometimes accelerated successional changes over vast areas—causing the simultaneous aging of forests over entire landscapes, preventing the establishment of new pioneer plant and animal communities, eliminating the diversity of nature, and excluding the ecological niches of many forms of wildlife. The immediate impact is far greater in certain even-aged and short-lived pioneer forests such as jack pine, lodgepole pine, and aspen than in long-lived forests such as Douglas-fir, red pine, ponderosa pine, and Sequoia, or in shade-tolerant forests of maple-beech birch, or spruce and fir.

We have also "controlled" (mostly *eliminated*) the large carnivores, such as the timber wolf and cougar. Yet they were the only effective predators of the large herbivores—the elk, moose, and deer. Excessive herbivore populations and the consequent overbrowsing, overgrazing, starvation losses, and necessary herd-reduction programs are old stories now.

And we have also, until recently, tried to control forest insect infestations with

pesticides, or by felling and burning infested trees. We sometimes "clean up" wind-damaged forests, and exotic plants have been introduced—even deliberately.

But our fire policies have the most powerful and pervasive effects. In a sense we are committing our parks and wilderness areas to a grand ecological experiment, by inadvertently trying to produce climax forests over vast areas—on a scale that may never have occurred before.

The consequences of this program are not only unintended, but in most cases unknown, for ecologists can find few examples of such circumstances within comparable ecosystems. This is simply not the way it was in primeval nature. We clearly have this situation in the Boundary Waters Canoe Area, where my own research is relevant, and also in Yellowstone National Park, Sequoia-Kings Canyon National Parks, and probably many other areas. (I mention these examples because the ecological background has recently appeared in conservation journals. See recent issues of *National Parks Magazine* and *Naturalist*, for example.)

A SOUND POLICY

If past policies are not resulting in the preservation of nature, then what *is* an ecologically sound policy? First, we must have clear, specific, and biologically attainable objectives for each area. Policy statements should spell out the philosophy of ecosystem management, and the biological nature of the ecosystem to be maintained or restored.

Philosophically, the focus should be on restoring the primeval *environment*. What we are interested in is preserving the total *system*—the ever-shifting mosaic of plant and animal communities. We cannot freeze nature into a static mold. What we must do is simply offset the disturbances caused by modern man.

Our concept of the ecosystem to be preserved or restored should be based on detailed studies of vegetational and faunal history, and on an inventory of present plant and animal communities. Fortunately, forests write their own history in tree rings. And many forests in our Parks and Wilderness Areas still date from the primeval period.

Sophisticated methods for reconstructing the primeval scene are available where such tree-ring records can be obtained. By using ring counts on old fire-scarred trees, it is possible to determine the fire history for hundreds of years. And by obtaining the ages of forest stands over whole watersheds, it is possible to correlate the age structure of present forests with this fire record.

Written records or old photographs and drawings can also help, especially the early U.S. Land Office survey records, explorers' diaries, old newspapers, and similar sources. Preserved pollens, larger plant remains, and charcoal in lake sediments or peat bogs have recorded plant communities over much longer periods. They can be used to connect information about the recent past with the situation hundreds or even thousands of years ago. Indian and early-man archaeological sites are an important source of faunal records. And carbon-14 dating now makes it possible to place firm dates on many organic sediments, fossils, and archaeological finds.

Decisions must be made on ecosystem objectives when this assessment of the primeval ecosystem is complete, and when an inventory of present communities is available. The historical research and the inventory will allow judgments about the degree to which present ecosystems have changed from the primeval. The objectives should spell out the vegetational, faunal, and environmental characteristics to be achieved.

But they are *not* to be viewed as static prescriptions for each landscape unit. They should simply detail such things as the vegetation types and successional stages to be encouraged, the approximate proportions of the area that might be occupied by each type and stage at any one time, the native fauna to be encouraged, and the significant natural environmental factors that may require attention.

GENERAL STRATEGY

The proportion of the area to be occupied by various successional stages is a key

decision. If possible, it should be based on virgin-forest age classes or other solid evidence of the frequency of new successions.

Once ecosystem objectives have been set, a strategy to achieve these goals is needed. Unfortunately, strategies are not yet available for many ecosystems, and in such cases the initial focus must be on relevant ecological research and technique development.

But the basic general strategy is clear. It will simply be to replace missing vegetation types or faunal elements, and to see that important natural environmental factors are present at approximately their natural frequencies. When these requirements are met, we accept as natural the changes in plant and animal communities that may occur in both place and time. We are not really trying to manage nature or control succession. We must not insist on a given vegetation type or animal community for each site.

Fortunately, in the United States, many Park and Wilderness ecosystems are still close enough to the primeval that drastic changes in flora and fauna will not be needed over much of the area. It is mainly the proportion of successional stages that will require corrective action. In contrast, in much of Europe, the Middle East, and the Far East, virtually all primeval ecosystems have been destroyed for so long that the concept of the "natural" ecosystem is hardly relevant.

ACTIONS NEEDED

What specific kinds of actions are needed to implement this general strategy? I can suggest several, and some of these are already endorsed by the National Park Service, the Forest Service, and other agencies that manage nature reserves:

1. Re-introduce missing members of the animal communities wherever possible. This includes both herbivores and carnivores.
2. Restore native vegetation where it has been badly disrupted by past logging, grazing, agriculture, etc. (Soil preparation, seeding or planting, and mechanical vegetation control may be necessary where changes have been major.)
3. Avoid the introduction of exotic plants, animals, and fish. Eradicate exotics already present where feasible.
4. Allow native insect and plant diseases to reap their toll. Cease the application of all pesticides, herbicides, and similar chemical controls.
5. Do not clean up blowdowns, or insect- and disease-killed forest stands.
6. Assure a natural fire regime where fire was a significant environmental factor in the primeval ecosystem, by prescribed-controlled burning if necessary.

Only natural environmental factors should be employed, to the maximum extent feasible. Artificial seeding and planting, soil preparation, and mechanical vegetation control are justified only to offset major disturbances by modern man. Where seeding or planting are used, only local seed sources should be used.

Fire policies and programs need discussion, because fire is such a powerful environmental factor, and because it is one of the few major natural factors over which we exert control. Today, we are greatly reducing the area burned in many nature reserves where fire was once the single most important factor in generating new successions. In such ecosystems we really have at least six fire policy options, and a decision cannot be avoided. These options are:

1. Attempt fire exclusion, and accept the slow but pervasive changes in plant and animal communities that inevitably follow.
2. Allow "safe" lightning-caused fires to burn; allow also for some other wildfires that cannot be controlled, but extinguish the rest. If this results in less than the natural fire frequency and burned area, so be it.
3. Allow "safe" lightning fires to burn, allow for some other wildfires that cannot be controlled, but prescribe enough additional controlled fires to assure the natural fire regime.

4. Suppress all wildfires to the extent feasible, and duplicate the natural fire regime with prescribed-controlled fires.
5. Allow all wildfires to burn unchecked unless life or property are directly threatened, and hope that a natural fire regime will result.
6. Abandon the ideal of natural ecosystems, and turn to full-scale vegetation and environmental manipulation by mechanical and chemical means, seeding, planting, etc. Attempt to produce a desired vegetation with the tools of applied forestry.

THE OPTIONS

For most areas I favor either option three or four, depending on the particular fire control, human safety, and property-safety considerations of the area. Either would provide approximately the natural fire regime, and avoid the risk of letting wildfires get out of hand before control is attempted.

The second option, allowing for "safe" lightning fires and some escapes, but not using prescribed fires, may also be acceptable where it would yield close to the natural fire regime. In isolated mountain areas this may be a valid policy if there is little possibility of fires escaping to lands outside the wilderness or park.

The last option, mechanized forestry, seems to me to be inconsistent with the basic philosophy and objectives of our National Parks and Wilderness Areas. It is, however, urged as the only realistic and practical choice by some foresters and by many of the forest industries, who point out that a commercial harvest of timber could be obtained as a byproduct. Timber cutting is now practiced in parts of the Boundary Waters Canoe Area, in Algonquin and Quetico Provincial Parks in Ontario, and in several other large Parks in Canada and other countries. But in none of the cases with which I am familiar is there a serious attempt to duplicate primeval vegetation conditions after cutting. Unfortunately, this option, without commercial incentives, will have to be resorted to in some auto campgrounds and other high-use sites.

I reject the fifth option, allowing all wildfires to burn, both because it endangers life and property, and because with recreational use the location and frequency of fires would be unnatural. We cannot endanger human lives either inside or outside wilderness areas, and we cannot risk damage to commercial forests or to structures outside.

It is clear also that I do not favor the first option—attempted fire exclusion. This *is* the present practice in many areas, but as pointed out before, the ecological consequences are great and uncertain.

A further problem, which we may already be facing in many areas, concerns the accumulation of forest fuels with fire exclusion. In cool coniferous forests there is a gradual accumulation of litter and humus on the forest floor. And in severe drought this organic matter can become a major fuel. Also, as forests mature, the total standing volume of flammable material increases, and often there is more dry dead wood in old stands.

Some forests certainly reached these stages under primeval conditions, and I do not mean to imply that old forests are unnatural. But if we attempt fire exclusion in an ecosystem consisting of maturing even-aged forests, we may force a totally unnatural preponderance of old stands upon the landscape. If a wildfire does then escape during severe fire weather, the potential for a real conflagration is present. Its ecological consequences may be most unfortunate, to say nothing of safety problems.

RESEARCH NEEDED

But it must be emphasized that in most areas we are not yet ready to introduce prescribed fires of the kinds required ecologically, or on the scale needed to duplicate the natural regime. Much experimentation will be needed to achieve technical expertise in firing and control methods, in gaging weather and fuel factors, and in understanding the fire prescriptions necessary to achieve the ecological effects of the natural wildfire regime. The size of areas

to be burned, the frequency of burning, and the burning techniques are all matters of choice that require research. There is no need, and indeed it may be impossible, to burn every year. One might allow major burns only once every 10 to 20 years. This will depend on the natural fire frequency as well as on burning weather.

There has already been much research in prescribed burning, and many applications are being made. But for ecosystem applications in the virgin wilderness, we are talking about the introduction of severe ground fires or even running crown fires in mature forests. These fires must in some cases be severe enough to kill most or all of the trees within the burn. Of course, only a very small percentage of the park or wilderness would be burned at any one time. The aim would be to slowly re-establish the primeval distribution of forest age classes and vegetation stages. We have little relevant experience with prescribed burning to achieve this.

Research to develop the needed expertise in both prescribed burning and fire ecology is now under way adjacent to the Boundary Waters Canoe Area and in Sequoia-Kings Canyon National Parks. These studies are new, and much more work is needed. Meanwhile, as we await the development and acceptance of prescribed burning, ecologists and managers can proceed with inventories of present plant and animal communities, and with historical research to document the primeval ecosystems. Fortunately, we do have some time yet, because most successional changes in vegetation are slow.

And meanwhile the public must continue to exercise great care with fire in our Parks and Wilderness Areas. Smokey Bear has perhaps oversold his message—he should be telling us that *some* fires can help the forest and create new homes for wildlife. But we must leave prescribed burning to the experts, and prevent all man-caused wildfires.

Air and water pollution and soil erosion are being suggested as obstacles to the use of fire in ecosystem preservation programs. Fire opponents suggest that intolerable smoke would result, and that there would be excessive inputs of soil nutrients and sediment into lakes and streams.

SMOKE NOT SMOG

Let me give a few reasons why I think these fears are unfounded. First, studies show that forest fire smoke is chemically different from urban or industrial smogs. Smogs contain large amounts of sulfur and nitrogen oxides, carbon monoxide, ozone, and peroxyacetyl nitrate (PAN). Forest-fire smoke contains far less of these injurious compounds. It is composed mainly of carbon dioxide, water vapor, smaller amounts of carbon monoxide, small quantities of olefins and ethylene, and particulate matter. It does add some pollutants, but it simply does not pose the same threats to human health or vegetation.

Furthermore, urban and industrial smogs are emitted continuously, and in the areas of our densest populations. But fires in Wilderness would occur only on a few suitable burning days, and then only in years when burning was feasible and needed, and in remote wildlands. The most serious urban smogs occur where the local atmospheric circulation permits accumulation of toxic gases. Fires in wilderness would contribute to these local problems only where a Wilderness occurs within the same "airshed". This is not common.

Most of the mineral elements released in the burning of forests are not lost through runoff. They are simply recycled back into the plant and animal ecosystem. If this were not so, fires would have depleted the forests of North America long ago. The truth is that many northern conifer forests owe their vigor to this periodic recycling of nutrients—it is part of nature, and it has occurred countless times in the past.

Although some past studies have provided data on this question, we are just now really getting the facts. The available studies suggest that there are some nutrient releases to streams following fires, but these releases may be no larger than those accompanying commercial timber harvests. Furthermore, fires in nature do not remove large volumes of nutrient-containing wood, bark, and foliage from the ecosystem as

does commercial tree harvesting. And fires in nature or prescribed fires generally would occur on any one watershed only at long intervals.

EROSION RARE

The popular notion is that massive soil erosion usually follows forest fires. But personal observations over many years in many regions have convinced me that this rarely occurs in natural forests. (A dramatic exception is the chaparral type in Southern California.) On very steep terrain it may occasionally happen for short periods, but even there prompt revegetation of the burns usually stops soil movement within a year or two. On steep slopes, the combination of clearcutting, careless road construction during logging, and slash-burning after logging may cause serious erosion. (And this is poor forestry, too!) But this should not be equated with the effect of fires in the virgin wilderness. Again, if disastrous erosion had followed most fires in nature, the virgin wilderness of North America would not have contained the beautiful conifer forests still present in many fire-dependent ecosystems.

One may also ask whether fires in Parks and Wilderness Areas would not deplete atmospheric oxygen. But this argument is invalid, too. A tree will consume just as much oxygen when it dies and decays from causes such as wind breakage, diseases, or insects, as when it is consumed by fire. The *rates* of oxygen consumption are much different, but the *amounts* are identical. Since all trees are mortal, it really matters little to the earth's oxygen balance whether trees die gradually in an aging forest, or suddenly in a fire that covers a limited region. The new forest on the burned area will again be producing a large net output of oxygen within a few seasons, while the old climax forest may not produce any more than it consumes.

But regardless of these arguments, one thing is clear. Fire *was* part of the natural environment in many of our most cherished nature reserves. If we are to truly preserve natural ecosystems, we must allow fire to be part of the system. And if such natural events in the past produced acceptable conditions, we can expect them to continue to do so in the future.

Today there are still areas of *de facto* wilderness outside designated Wilderness Areas, National Parks, and other nature reserves, especially in the West and Alaska. The ecosystems of some of these areas are still fairly intact. But as our population rises and pressures on the land increase, the designated reserves may become virtually the only lands where relatively complete ecosystems can be maintained.

LOOK TO EARTH

Let me also stress that our major nature reserves must be kept large enough to defend as viable ecosystems. They must be large enough so that reintroduction of fire is feasible, and also so the impacts from commercial forests, cultivated lands, and industrial areas will not impair them. The home ranges of significant animals and birds must be protected adequately—especially the rare or endangered species with large home ranges, such as the timber wolf, cougar, grizzly, caribou, and bald eagle. We have no firm guidelines for minimum ecosystem size. I suspect the answers will vary for each area and each problem. But obviously, where the area is too small to protect from serious external impacts, we are in trouble. Recent problems with water levels and the jetport near the Everglades National Park are cases in point.

I am sure that several of the suggestions in this article will provoke deep questioning in many minds. You will ask if somehow there aren't simpler ways to preserve nature, or to manage our National Parks and Wilderness Areas. I sympathize with you, because I have undergone the same soul-searching myself. And you may ask, is the preservation of nature really that important? It sounds like a big job; it will take more research, more time, more money, and more people trained in ecology. Can we afford to devote so much time and energy to this problem?

My answer is *YES, we must!* We are not talking about preserving a few Parks and Wilderness Areas to be used as giant playgrounds. We are talking about keeping our perspective on human life in relation to the

earth's ecosystems. And we may even be talking about the survival of mankind! For if we are ever to understand the living ecosystems of the earth—the only life in our solar system as far as we know—then we must keep some remnants of this natural system before us. And for a long time yet!

Have *we*, in our wisdom, already learned all that our *children* will ever want to know about the structure, functioning, and evolution of the natural world? Is it possible that they may yet need some of the genetic diversity of the plant and animal life that is increasingly confined to our remotest lands and nature reserves?

The answers to these questions are clear enough to most of us by now. We part with these last remnants of the natural world at our peril. And the choice is simply a matter of priorities. If we can afford billions to recover a few bits of sterile dust and barren rock from the moon, perhaps we can also afford a realistic and ecologically sound program to preserve a few examples of the life systems of *PLANET EARTH!*

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UNDERSTANDING THE VISUAL RESOURCE

by FLOYD L. NEWBY, *Division of Recreation, Bureau of Land Management, U. S. Department of the Interior, Washington, D. C.*

ABSTRACT. Understanding our visual resources involves a complex interweaving of motivation and cognitive processes; but, more important, it requires that we understand and can identify those characteristics of a landscape that influence the image formation process. From research conducted in Florida, three major variables were identified that appear to have significant effect upon visual preferences: (1) visual order, (2) visual complexity, and (3) edge relationships. The interaction of these variables produces spatial definition, which promotes or retards a sense of physical, visual, and psychological access. Without an understanding of the mechanisms and principles involved, landscape management to promote environmental integrity is strictly a hit-or-miss proposition.

IN A TIME when we are being almost overwhelmed with clichés about environment and ecology, we must recognize that man is truly a visual animal with respect to his environment. He learns more, reacts more, and appreciates more through his visual system than through any other sense. Concern for quality in our visual resources has assumed an urgency in the priorities of public issues.

In light of the developing urgency and rationalization of the significance of the visual environment to work, health, and enjoyment, it is amazing that so little has been known about how the environment is actually experienced. Almost as compensation, a proliferation of public and private programs has evolved to regulate, preserve, and enhance the appearance of elements in the visual environment. My research has been concerned with some of the factors that possibly contribute to the broader question of how man visualizes his environment.

Man's perception of his visual world must involve not only individualistic and transitory motivations but also those features of an environment that have potential to shape basic imagery. It is these features that challenge us to understand, to interpret, and to manipulate them as a means for satisfying basic psychological and social needs in a complex world society. Thus the challenge has become one of understanding the processes and mechanisms of perceptual experiences.

PERCEPTION OF THE VISUAL RESOURCE

Perceptual experience involves intricate relationships between what is seen and the individual doing the seeing. The standard cliché for these relationships is that "Beauty is in the eye of the beholder". There is little argument when dealing with superlative examples of visual landscapes, nor is there any great disparity when identifying what is chaotic and ugly.

The real problems exist within the ambiguous middle range of the natural beauty continuum. Within this range are found the majority of landscapes to which man is exposed throughout his life—landscapes that support or destroy the imagery of movement from here to there. These intervening landscapes have potential to enhance, detract from, or do nothing to the experience of man moving through an environment. If a landscape does in fact possess such potential, then perhaps beauty can be attributed to more than merely a set of preconceptions uniquely held by each individual.

Perception of a visual display is extensive and expansive. It radiates across scientific, philosophical, and artistic concept borders to the extent that virtually any science or art makes a contribution to the understanding of the perceptual process. Of particular importance is the interaction of the sciences with the traditional arts. Perceptual psychology and landscape-design theory are perhaps the more fruitful contributors to an understanding of this phenomenon.

With the explosive increases of driving-for-pleasure occasions, perception in motion is of particular concern to managers of potential resources as well as existing visual resources. In simple fact, the over-expanding transportation system is creating visual resources out of lands that were previously inviolate to John Q. Public. The hinterlands have been opened, and the public is incensed over both real and imagined destruction of landscape integrity. Expectations born out of the desensitizing mechanisms of urban living are not being realized, nor can they if we fail to understand the psychological and visual impacts of land manipulation.

An environment must be accessible, not only in physical terms, but also in psychological and visual terms. It must not deny but rather encourage participation, involvement, and choice. Without such attributes, an environmental display becomes nothing more than a reflection of everyday life space with its monotonous and nonmotivating character. This is a situation to be avoided.

A search for meaning within the visual world has been the natural product of man's experience with his environment. He creates his images based upon what he sees, and what he perceives is a function of the clarity of the information being presented. The mechanisms of visual information transmittal and the constraints of reception are the major problems. Why information reception differs between individuals is a major concern if predictive capabilities concerning the aesthetic response potential of various landscapes is to be developed.

PERCEPTUAL SCALE

Perceptual imagery is a dynamic manifestation conditioned by man's sensed relationship to his environment. This is a psychological variable that relates organized substance to interpersonal motivation and behavior. For instance, while walking, man senses the texture of the walking surface, the warmth or coolness of the surrounding air, the constrictions and releases of changing space, and the alternating patterns of light and shadow; he becomes immersed in the tactile qualities of his proximate surroundings.

The personnel or immediate space of the individual is drastically altered when he is involved in an automobile driving experience. Scale relationships are expanded and detailed perception is reduced. Mass, space, color, and movement interact as substitutes for the sensual intimacy experienced at pedestrian scale.

When you are driving, information is presented at a rate that is both stimulating and stressful. Patterns and relationships between visual components are more accessible, but perception of visual detail is negated because time and position do not encourage visual or psychological lingering. At automobile scale, vision can be expansive or enclosing in terms of what can be seen. At this scale the simple may be transformed into the complex, based purely on the rate of information presentation. The phenomenon of vision in motion acts to integrate and transmute single visual entities into understandable and coherent patterns of light, mass, and space.

The paradox of perceptual scale is that, as movement is accelerated, the relationships within and between visual elements become more apparent. If the apparency is hampered by discordant organizations, then positive imagery does not develop. Creation of mass or space, which is inappropriate for a particular movement scale, may result in adding nothing to a visual experience; or it may restrict image formation. Nonrelevant visual formation may produce visual stress or encourage monotony, both of which are undesirable from a land-manager's standpoint.

A roadside landscape's positive affective (emotional) response potential is a function of an observer's movement scale through or across it. Without an understanding of the relationship between an observer, his manner or mode of movement and the organization of a visual resource, anticipatory assessment of observer response to landscape alterations is strictly hit-or-miss, a luxury we cannot afford.

PARAMETERS OF VISUAL ORGANIZATION

The basic tenets of perception incorporate the interaction of man's senses into a system whereby he is able to adapt to a world of constantly changing environmental conditions. Man in motion must rely very heavily on the visual system to adapt to the rapidity and overabundance of information being presented to him. The steps that lead an observer to interpret a visual entity in a particular way involve a complex interweaving of affective and cognitive processes. If the organizational characteristics of his visual world are not readily apparent, he manufactures, selects, or rationalizes the materials of image formation, provided sufficient time and motivation are available.

A question arises about whether or not it is desirable to allow image formation to develop uncontrolled or on the whims of observers. In many instances, a positive response is the desired response and one that is deemed socially acceptable in terms of environmental involvement. If a visual display is difficult to organize perceptually, it provides less information for positive imagery than a display possessing organized and coherent relationships between parts. The parameters of organization thus become critical if the desired image is to be available at all levels of discriminating capability.

Visual Order as an Image Determinant

Order in the visual world refers to the existence of some similarity of physical characteristics among the parts or of some discernibly harmonious space relation among them *(Litton 1965)*. A landscape having positive visual value has it because a person of ordinary experience can see the compositional relationships of known and recognized things. Normally an individual will tend to seek for or try to locate a sense of rightness and continuity in his visual surroundings. Because of his tendency to order and organize virtually every aspect of cultural learning, man has come to expect a degree of established order within his visual world.

Visual order is recognized through perceptual establishment of relationships within and among the elements of a visual display. Actual organization requires that each element conform to its context or to an observer's expectations, which may or may not be realistic. People have a difficult time relating to the unfamiliar, and they become bored with too much of the familiar.

If the elements of the environment relate to each other, they exhibit a degree of order, and the intricacies of a visual display are more likely to allow an observer to perceive an image based on the intensity of that order. This is especially true when man is in motion. A visual display without some semblance of order requires excessive time to perceive, and the observer will seek out general forms rather than time-consuming detail. In essence, visual order encourages perceptual lingering, whereas visual chaos produces stress and alienation.

Visual Complexity as Opportunity or Constraint

Complexity relates to the intricacy of the relationships, which affect the rate with

which information can be perceived. Obviously, complexity increases with the number of elements that can be identified. These elements are space-defining components such as vegetation, topography, and water. How an individual processes the available information will be a function of his visual experience and the organizational legibility of the visual elements.

Each individual has his own level or degree of complexity tolerance, which is dynamic in the sense that it shifts upward as perceptual grasp is refined. Some familiarity must be present to retard stress; but a degree of the unusual, the unknown, or the unperceived must exist to prevent boredom. Accordingly, simplicity in an environment can be a deterrent to visual pleasure, particularly if flow experience or movement is restricted. If a movement system allows the observer to match his speed to his level of perceptual complexity, the potential for positive response is considerably enhanced. Increased rate of movement provides stimulus complexity in time to an inadequate or low stimulation complexity in space.

Apparently an optimal amount of complexity exists for each individual, which serves to maintain perceptual interest at a high level. Through the processes of selection, humans tend to demonstrate a preference for complex visual environments rather than simple obvious ones, particularly under conditions of increasing order or visual accessibility. My recent research in Florida gave definite support to the thesis that perception of complex visual stimuli depends as much or more upon the quantitative (complexity) and qualitative (order) characteristics of the stimuli as it does upon motivational and behavioral characteristics of the observer.

Edges as Visual Organizers

There is need to emphasize effective circulation in and around a given visual landscape so that its order and complexity may be revealed in a positive manner. Regardless of whether perception results from an observer's static or flow experience, landscape elements are organized and identifiable by virtue of what designers call "edges."

Edges refer to perceived or implied dividing lines between landscape elements: they are lines in which surfaces meet and individual identity becomes apparent; they are those critical positions depicting relationships between parts. But even more important, edges serve a variety of functions: they serve to simplify or complicate organization by virtue of their number and configuration; and they create order through their convergence into a perceptually viable array. Thus the degree of order and the level of visual complexity within a landscape are set by the edges found within the system.

The effect of edges upon image formation is dynamic and changes in response to perceptual need and movement scale. For the most part, edges are not used as movement systems; but they do, by virtue of their defining role, dictate how visual access can be accomplished for maximum contrast and variety of experience.

PERCEPTUAL ORGANIZATION IN RESOURCE MANAGEMENT

An individual has a propensity to see only those things that are consistent with his established frame of reference. In light of a growing awareness by the public and resource managers concerning our visual resources, it is vital that we understand the mechanisms of image formation. If a sensitivity for scenic amenities is developed, the important variables of visual organization can be modified or molded to preserve both the integrity of the resource and the experience an observer harvests from that resource.

Because the majority of landscapes are categorized from flow experiences on highways, the factors of order, complexity, and edge effect are integral to planning landscape alterations. The interactions of these variables produce spatial definition that encourages or discourages physical, visual, and psychological access. To understand these interactions, we must look to concepts from design, perceptual psychology, ecology, and the behavioral sciences. Such analysis can identify opportunities and constraints conditioned by the basic and social

needs of observers as well as the environmental integrity of the landscape.

At present there is no cookbook approach for understanding the visual resource, nor are there definitive procedures for insuring that scenic amenities become harvestable commodities. However, the fact that resource managers are becoming sensitive and responsive to environmental interactions opens new avenues for developing a positive approach to the assessment of the aesthetic response potential inherent in all visual resources *(Newby 1971)*.

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EXTERNAL BENEFITS OF NATURAL ENVIRONMENTS

by LARRY W. TOMBAUGH, *Staff Associate, National Science Foundation, Washington, D. C., formerly Project Leader, USDA Forest Service Cooperative Forest Recreation Research Unit, Raleigh, N. C.*

ABSTRACT. Existing methods of assessing economic benefits arising from certain physical environments left in a relatively natural condition do not include estimates of external benefits. Existence value is one such external benefit that accrues to individuals who have no intention of ever visiting the area in question. A partial measure of the existence value of National Parks has been found. Additional research in this area should yield information important to land-use decision making.

MY ASSIGNMENT for this Symposium is to discuss research progress in the identification and measurement of external benefits arising from land areas left in a relatively natural condition.

The concept of "externalities," the generic term for a variety of specific kinds of market failures, occupies an important position in modern welfare economics. If externalities are present, the equilibrium approached by the workings of a competitive market mechanism will not necessarily be a position of maximum efficiency or economic welfare. Social costs or benefits will not equal private costs or benefits. The market will produce either too small or too large an output of some goods and services.

Various kinds of externalities are often assumed to be associated with outdoor recreation, and this is partially the justification for providing certain recreational services in the public sector. But what are these external effects? Can they be measured in terms that permit comparison with other kinds of benefits and costs? The answers to these questions are important to the rational formulation of public policy involving alternative uses of natural resources.

Externalities can be classified as: (1) external benefits, or economies, arising from production; (2) external benefits arising from consumption; (3) external costs, or diseconomies, arising from production; and (4) external costs arising from consumption. In my brief stay at the Cooperative Recreation Research Unit at Raleigh, I was interested in specific types of external recreation benefits within the first category —those arising from production.

Robert Dorfman *(1964)*, in his book *The Price System*, offers a clear example of this type of external benefit. Dorfman points out that the Salton Sea, in southern California, is one of the country's most productive inland fisheries. A high nutrient level is maintained through the tremendous input of fertilizers from the many farms of the Imperial Valley. The farmers, in other words, pay for the fertilizer; and the fishermen enjoy part of the benefits without being made to contribute to the costs.

This situation leads to a misallocation of resources. If the farmers act as economic men, they will apply fertilizer until an additional dollar's worth will just produce an additional dollar's worth of crops. If other inputs are being used efficiently, this equating of marginal costs with marginal returns will maximize their net revenues. Obviously, the farmers would not want to spend an extra dollar for fertilizer if that application would add only 98 cents to the value of the crops. But suppose it increased the dollar value of fish yield by 5 cents? At the margin, the application would add more to output than to costs. Unless the application is made, an inefficient solution will result. Under a price system, the individual farmer will pay no attention to the impact of his activities on the fishermen.

A similar example could be drawn from recreation if a situation could be found in which the mere provision of a particular recreation area or facility provided benefits to non-users as well as to users. Wilderness is often thought to produce this kind of external benefit.

Outdoor recreational services are also often claimed to produce external benefits of the second type—those resulting from consumption of the services or participation in outdoor recreation activities. Ruth Mack and Sumner Myers *(1965)*, for instance, argue that there are "benefits which result from the advantage to *all* people, whether or not users of outdoor recreation, of living in a country where more rather than fewer people are educated in the ways of the out-of-doors."

Suppose this hypothesis is correct. Then, if the individual is required to pay the full costs of outdoor recreation experiences, he will adjust his participation so that his perceived benefits per unit of cost for an additional hour of recreation just equals the benefits per unit of cost for additional units of other goods and services. But if benefits from the additional hour of recreation accrue not just to the individual but to all of society, an underallocation of time devoted to recreation will occur in the private market.

External diseconomies, or costs of production and consumption, are mentioned here only to complete the discussion of externalities. This is not to minimize their importance, since almost all forms of pollution are examples of external costs. But my research—the topic of this paper—was concerned only with external benefits of production.

EXTERNALITIES IN ECONOMIC ANALYSES

Much government activity is directed toward correcting for various kinds of externalities so that a reasonably efficient allocation of resources is obtained within a particular distribution of income. Analysts of public policy alternatives are thus faced with the problem of identifying these external effects where possible. In some cases, actual measurements within a reasonable degree of accuracy can be obtained. In others, the externality can only be treated qualitatively. The reliance that can be placed on information provided by economic analysis increases as the proportion of total benefits and costs included in the analysis increases.

Outdoor recreation has long been recognized by economic analysts as a particularly intractable problem. For a variety of reasons, including the perceived existence of many kinds of external benefits, the public sector has traditionally played a dominant role in providing outdoor recreational opportunities. Prices, which for most goods indicate the relative willingness of consumers to pay, have not been generated. And willingness to pay for goods and services is generally considered to be an appropriate measure of economic benefits.

Because of the absence of reliable market signals, and faced with growing numbers of resource allocation questions involving outdoor recreation, economists have directed considerable attention to the development of ways to measure the *demand* for certain kinds of recreational opportunities. Estimates of willingness to pay can be derived from economic demand curves. None of the methods developed to date are both theoretically sound and readily adaptable to practical applications. Much more research is needed.

But suppose we could put our faith in

one of the existing methods. Would it actually reveal the full willingness to pay, or the total economic benefits, of a particular recreational opportunity? The answer is no, as long as external benefits are present. All the known methods of assessing demand are based on some kind of response of *actual users* to changes in real or simulated prices. External benefits are not included. Yet external benefits are components of total willingness to pay and should ideally be included in economic analyses when they exist.

Important research questions are: (1) What external effects do arise from the production and the consumption of outdoor recreation services?, and (2) how can they be measured? Many types of external benefits will undoubtedly always defy measurement. Those hypothesized by Mack and Myers provide an example. There seems to be no way to measure the economic benefits that accrue to society at large because the citizenry is generally informed about the out-of-doors. But some progress in identifying and measuring specific kinds of externalities is bound to help clarify thinking about gains and losses associated with alternative uses of natural environments.

EXISTENCE VALUE AND OPTION VALUE

My work at the Cooperative Research Unit at Raleigh was concerned with two particular external benefits arising from the "production", in a loose sense, of identifiable units of relatively natural environments. These two types of external benefits are: (1) existence value and (2) option value.

The concept of existence value has been recognized for some time, although the term has not yet been used in the literature. John Krutilla *(1967)* has used the term "bequest motive" to express roughly the same idea. I prefer existence value because it is less specific in its connotations about motivations; i.e., it does not imply a handing down to later generations. Whatever the term, I am talking about the external benefit of natural environments (or any kind of good) that accrues to individuals having no intention of ever visiting the site or using the good in question. These people are willing to give up resources simply to know that the area, feature, or good exists in a particular condition. As mentioned earlier, this type of external benefit is frequently claimed to be associated with wilderness and outstanding natural features.

Option value was first described by Burton Weisbrod *(1964)*. In principle, his arguments apply to all goods characterized by: (1) a demand that is infrequent and uncertain; (2) high costs of expanding production once output is curtailed; and (3) an absence of perceived close substitutes. Many National Parks, wildlife species, and cultural features fall into this category. An underallocation of resources to these goods might occur if a private producer attempted to maximize his profits, even if he could operate as a perfectly discriminating monopolist and thus capture the consumer surplus of each user.

Weisbrod's argument depends on the existence of persons who are unsure of their future demand for the goods. Some of these people may, in fact, never express a demand. In other words, an individual may have some expectation of visiting, say, a particular National Park sometime in the future, but in actuality may never get there. Yet if people with these expectations of future demand behave rationally, they will be willing to pay something to maintain the option of using the goods in the future if they so desire.

Weisbrod calls this willingness to pay for the standing services of many types of goods *option value*. He uses Sequoia National Park as an example of a "good" that meets his requisite characteristics in the extreme and for which option value may represent a substantial proportion of total benefits received. If this is the case, efforts to estimate the benefits of Sequoia based on willingness of actual users to pay would understate the total benefits of Sequoia in its existing condition.

Economists at Resources for the Future, Inc., have recently developed a more rigorous way to demonstrate the possibility of an option value in excess of consumer

surplus. To me, the deductive evidence in favor of option value for certain kinds of goods is quite convincing. I hasten to add, however, that some other economists who have considered the subject do not share this view.

EMPIRICAL WORK

My research on external benefits was directed to the question whether empirical support for option value and existence value could be generated. Ideally, monetary measures for both would be developed in order to assure comparability with other resource values. But markets do not usually exist for external benefits because, in a large group, it does not pay any one individual to reveal his true preferences for the good or service. The problem is that no one can be excluded from enjoying the benefits. Once a wilderness is preserved, the satisfaction of knowing that it exists accrues to everyone. If one individual were asked to pay for this benefit, he would likely refuse, since no one can keep him from enjoying it. But perhaps some approximations can be found.

It is my opinion that many conservation/preservation organizations serve as focal points for the voluntary expression of various kinds of external benefits arising from natural environments, wildlife, or other objects of the groups' attention. They can be viewed as quasi-markets for these services. Consider the National Parks and Conservation Association, for example. Its primary responsibility, as stated in its monthly publication, is to help protect the national parks and monuments of America. Many people willingly and voluntarily give up resources to help assure that this responsibility is met. Admittedly, contributors are seeking to get parks established and protected through the political process rather than through the market. In this way, they can avoid paying the full opportunity costs of the resources involved. Nevertheless, their contributions must be a partial reflection of the utility expected to be gained. It makes sense, then, to consider these voluntary payments as partial measures of benefits of National Parks to be compared with the true (opportunity) costs of establishing new parks or maintaining existing areas in a relatively natural state.

Members of the National Parks and Conservation Association provided the data for my research. The membership roles of the Association were systematically sampled to obtain information on the magnitude of individual contributions and on addresses of contributors. Other information, such as estimated probability of future use, was obtained from a questionnaire mailed to sampling units.

Four percent of the sample donated money to the National Parks and Conservation Association while having no intention of ever visiting a National Park. These contributions, it seems to me, can be interpreted as expressions of existence value. Whatever their motives, these people are willing to voluntarily give up resources to help assure the existence of an environmental feature that they will most likely never see. These people apparently benefit from knowing that National Parks exist, yet their benefits will never be registered in visitor counts or in entrance fees. Some degree of existence value is also likely reflected in the contributions of other members of the Association, but it could not be identified as such.

It may be argued that 4 percent is hardly worth bothering with. But it should be remembered that there are real incentives to not express preferences for external benefits at all. In light of the revelation of preference problem, it is surprising that any existence value as defined in this study could be identified. Contributions as a reflection of total willingness to pay are probably further reduced because the outcome of the efforts of the National Parks and Conservation Association are likely less than certain.

Option value is more difficult to assess and to isolate from other forms of willingness to pay, such as existence value and consumer surplus. As a first attempt, contributions were related to the expressed probability of future use of National Parks. The hypothesis, as suggested by Cicchetti and Freeman, was that the total value of contributions should exceed the total expected value of consumer surplus when

demand is uncertain. The difference would be option value. A positive difference was indeed found. But, because of a number of difficult definitional and conceptual problems, the results are still inconclusive.

The general conclusion that emerged from my research was that existence values associated with certain outstanding natural environments do exist. Economic analyses of alternative uses of these land units are likely to exclude important social benefits if they are restricted to benefits measured in terms of economic responses of actual users. Additional research directed toward the assessment of specific external benefits of land units now in a relatively natural state and being considered for development would likely pay big dividends.

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INVENTORYING RECREATION USE

by GEORGE A. JAMES, *Project Leader in Recreation Research, Southeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Asheville, N. C.*

ABSTRACT. Part I is a general discussion about the estimation of recreation use, with descriptions of selected sampling techniques for estimating recreation use on a wide variety of different sites and areas. Part II is a brief discussion of an operational computer-oriented information system designed and developed by the USDA Forest Service to fully utilize the inventories of recreation information available from over 21,000 recreation elements (sites and areas) of the National Forest System.

INVENTORYING

THIS PAPER is composed of two parts. Part I includes a general discussion about the estimation of recreation use, with descriptions of tested sampling techniques for estimating recreation use on a wide variety of different sites and areas. Sufficient detail is given so that interested persons will be able to decide which technique or techniques might be most suitable for their particular needs. It is likely that other excellent sampling techniques have been designed and tested by other federal, state, university, and private investigators, as well as foreign nations; but for one reason or another information about them is not readily available.

Part II is a brief discussion of an operational computer-oriented information system designed and developed by the USDA Forest Service. This system has been geared to fully utilize the inventories of recreation use which have been carefully and painstakingly gathered.

The need to gather reliable information about our recreating public—the kind and amount of use that occurs and the places where this use occurs—is urgent and critical. It will never subside. The things that we need to know a great deal about are becoming *more* numerous and *more* complex because *more* people engage in *more* activities *more* frequently on *more* developed sites and *more* classified areas with *more* kinds of facilities costing *more* money and occupying *more* land and *more* water under *more* intensive management while *more* stringent budgetary requirements demand *more* specific information to satisfy *more* public interest in *more* types of programs coordinated with *more* agencies involved in *more efforts.*

Inventories are an essential and expensive requirement of all business ventures. Inventories of recreation use, users, and the physical resource serve many useful purposes and are vital to recreation-oriented federal, state, and municipal agencies, individuals and private organizations, congressional committees, highway departments, chambers of commerce, newspapers, travel agencies, economic and market analysts, research scientists, writers, and a host of others.

Recreation planning and financing are based on the planner's access to reliable data about the total use of an area, the use of various facilities provided, the nature of

the visitation pattern, and an understanding of the socio-economic-ethnic characteristics, behavioral patterns, and motivations of the recreating public. Management and policy decisions can be improved greatly if the total planning process is based on reliable and current information.

Good inventories of use, and of the physical resource that provides such use, are essential for establishing cleanup and maintenance schedules; for predicting rate of facility depreciation and resource deterioration; for determining relationships between supply and demand and the need for providing additional activities and facilities and enlarging existing areas; for determining the number, kind, design, and location of future areas; and for alleviating existing conflicts between use and users. Sound budget planning, allocation of funds and manpower, and economic analysis depend upon complete and up-to-date information. And any effort to predict future use of the Nation's land and water areas, regardless of location or ownership, must be based on a comprehensive picture of current conditions that help to identify trends and patterns of use.

Much of the basic recreation-use data on which past management decisions were based were obtained by experience and observation. Many of these use estimates were very likely good; others probably were misleading. Under the increasingly complex current situation, such "guesstimates" will not suffice and must be replaced by information that is precise, reliable, and uniform. In fact, federal recreation agencies were directed by legislation in 1964 (Land and Water Conservation Fund Act, PL 88-578) to improve their estimates of visitor use as rapidly as time, funds, and talent permit. One significant accomplishment was the development of a rationale and procedures for the uniform reporting of outdoor recreation data on a nationwide basis. (A Uniform Method for Measuring and Reporting Recreation Use On the Public Lands and Waters of the United States, 1965; prepared by Recreation Advisory Council Study Committee Number Two; 56 pp.) These procedures provided individual agencies with a frame of reference and a set of guides that permitted them to gather and report recreation information in common terms.

It is neither practical nor desirable to obtain a complete inventory of use and users on most sites and areas by counting all the visitors and recording their activities. The cost of this Herculean task would be prohibitive and all but impossible where recreation use occurs over large forest areas. Sampling is the logical approach for obtaining estimates of the desired parameters. If properly drawn, the sample provides the necessary information for making sound estimates of use and recreational activity. Sampling cost and the precision of the technique used must be commensurate with planned use of the data; that is, the least expensive method that will produce sufficiently reliable results should be used. Nor is it advocated that all sites be sampled. In most cases, sampling can be applied to selected representative sites; and the estimates can be utilized as yardsticks to use on other unsampled sites.

Use-sampling techniques might employ one or more of several methods of data collection, including mechanical and electronic counting devices, optical scanners and cameras, telephone and mail surveys, existing or special records, observation, self-administered questionnaires and permits, and interview surveys. These in turn can be further classed into three principal types of enumeration systems: (1) self-counting, (2) direct-counting, and (3) indirect-counting.

Examples of self-counting systems, in which the recreationist provides use information about himself, include campground registration books and boards; charge areas where permit-vending machines, meter boxes, or automatic gates are installed; and self-registration questionnaires and forms. Direct-counting systems include census and sample counts, television and camera observation, aerial observation and photography, mail and telephone surveys, and similar procedures. Indirect-counting systems include such devices as electronic-eye and mechanical counters; self-activated or time-lapse photographic equipment, remote sensing devices, and such related indicators as water consumption and volume of refuse.

Recreation use on developed sites (including campgrounds, picnic grounds,

organization sites, hotels and resorts, commercial-public-service sites, recreation residences, observation sites, swimming sites, playground-park-sports fields, and recreation visitor centers) represents one of the simpler and less-costly sampling situations because the sites are of small size, vehicular and foot access to the sites are generally good, and recreationists as well as the activities in which they engage can easily be observed. Considerable research, beginning in the early 1960's, has been directed towards designing and testing sampling techniques for estimating intensive use that occurs on such developed sites.

Less intensive use on dispersed areas such as generally undeveloped country, large bodies of water, recreation roads and trails, natural lakes, ponds, reservoirs and other impoundments, and rivers and streams is generally difficult and costly to estimate. Such use is usually thinly scattered on land and water areas, which may be several hundred square miles in extent, highly mobile, and constantly in flux. Examples of recreation activities in dispersed areas including hunting, fishing, boating, hiking, mountain climbing, and driving for pleasure.

The following section contains a listing of selected sampling techniques that have been used successfully to estimate recreation use on both developed sites and dispersed areas. Coverage includes literature citation, a brief discussion of what the technique does and how it works, cost (where available), and general comments. All the sampling techniques discussed deal strictly with the problem of developing a complete and accurate picture of *current* conditions, not with the larger question of future projections. The sampling techniques discussed are satisfactory for short-term projections, but we need to know a great many more basic facts about our society and its behavior before long-term projections can be made.

(A bibliography on recreation use sampling techniques is available upon request from the Recreation Research Project, USDA Forest Service, Southeastern Forest Experiment Station, Asheville, N. C. 28802.)

ESTIMATING USE ON DEVELOPED SITES

Citation: James, George A., and Thomas H. Ripley. 1963. INSTRUCTIONS FOR USING TRAFFIC COUNTERS TO ESTIMATE RECREATION VISITS AND USE. USDA Forest Serv. Res. Pap. SE-3, 12 pp., illus. SE. Forest Exp. Sta. Also: James, George A. 1966. INSTRUCTIONS FOR USING TRAFFIC COUNTERS TO ESTIMATE RECREATION VISITS AND USE ON DEVELOPED SITES. (revised). USDA Forest Serv. SE. Forest Exp. Sta., 12 pp.; DOUBLE SAMPLING, FSH 2309.11 RIM HANDBOOK (Section 124.72), April 1970, Amend. 16.

What It Does: Designed to produce estimates of amount of use, by activity, on unsupervised developed sites, this technique makes it possible to update estimates from vehicle counts only during a several-year period following calibration. The sampling technique, called double sampling, was first developed and tested in 1961. It has been used to estimate use on approximately 1,000 USDA Forest Service developed sites.

How It Works: Each developed site and each recreation-use period for which estimates are desired must be sampled for a minimum of 12 days, each 12 hours long. Traffic counters are placed at each entrance of each site to be calibrated. To obtain the estimates, a ratio is developed between the desired statistic (visits, use by activity, total use) and traffic counts by simultaneously measuring both on each sampling day. On days when someone is not on the site counting people and recording what they do, the traffic counter alone provides the basis for use estimates. The regression formulas developed during the first year of site calibration can be used to provide estimates during the next several-year period from vehicle counts only, provided relationships between axle counts and associated uses are strong and there are no major changes in the site.

Cost: Average cost per site for first-year calibration is approximately $650 for labor and supervision, and approximately $75 each for pneumatic traffic counters. If relationships between use and the

traffic-flow pattern are strong, estimates can be updated for a 3- to 5-year period following calibration, thus reducing sampling costs to approximately $150 to $200 per year.

Many developed site groupings can best be handled for sampling purposes as "sampling complexes" consisting of two or more kinds of sites. For example, Alexander Springs Recreation Area, Ocala National Forest, Florida, consists of several kinds of contiguous sites; i.e., campground, picnic ground, swimming sites, and boating site. It is less expensive to sample a site complex as a whole than to sample its component parts separately. Total use indicated from the sampling process should be comparable in either case.

Comments: This technique can provide good estimates of use by activity, but does not provide a true estimate of number of visits because visitors may enter and leave a site several times during a given sampling day. The technique counts them as new visits each time they enter, and thus provides an estimate of number of *entries*, not a precise estimate of number of *visits*. Success of the technique depends upon an accurate traffic-count record. Frequent checking and adjustment of all traffic counters is essential. A slide-lecture presentation has been produced commercially to describe this sampling technique.

Citation: Bury, Richard L., and Ruth Margolies. 1964. A METHOD FOR ESTIMATING CURRENT ATTENDANCE ON SETS OF CAMPGROUNDS . . . A Pilot Study. USDA Forest Serv. Res. Note PSW-42, 6 pp. Pacific SW. Forest and Range Exp. Sta.

What It Does: Provides estimates of daily attendance (and corresponding precision of estimates) for a test set of several campgrounds from attendance measured in only one bellwether campground. Total daily attendance for a test set of 23 campgrounds was estimated from attendance measured in only one of them in a 1961 pilot study. Estimates of daily and seasonal attendance were within 10 percent of true attendance at a confidence level of 67 percent.

How It Works: The method consists of three steps: grouping campgrounds into sets, calibration, and estimation of attendance. Calibration consists of counting attendance in each campground in the group (on a minimum of 20 randomly selected days throughout the season for correlation-regression and 30 randomly selected days for ratio analysis); testing for relationships by correlation or ratio analysis; selecting indicator campgrounds; and computing equations for estimating attendance. The method can be used to update use estimates on all sites for a several-year period following calibration by measuring only one or two bellwether campgrounds.

Cost: Initial cost for calibrating all campgrounds is high, but generally less than cost of other sampling methods that require estimating attendance at individual campgrounds. Sampling cost per campground will vary with the number of sites included in the set, but they can be prorated over a several-year period.

Comments: The method can provide good estimates of daily and seasonal attendance, but does not provide estimates of kind of use. Standard procedures have not been devised for applying the method. The authors say that specific procedures must rest on examination, and possible modification, of statistical models for conformance with field conditions.

Citation: Wagar, J. Alan. 1964. ESTIMATING NUMBERS OF CAMPERS ON UNSUPERVISED CAMPGROUNDS. USDA Forest Serv. Res. Pap. NE-18, 16 pp. NE. Forest Exp. Sta.

What It Does: Estimates number of campers on several unsupervised campgrounds from information collected from one or a group of unsupervised campgrounds. The method was successfully pilot-tested in 1961 with one campground on which season-long number of campers was available, and eight unsupervised campgrounds.

How It Works: Campers were counted each evening on approximately 18 ran-

domly selected dates on one or more unsupervised campgrounds. Most of these counts must coincide with records from at least one unsupervised campground on which full counts are made throughout the season. Regression and ratio estimation procedures are used to produce estimates of number of campers on all unsupervised campgrounds in the area.

Cost: Estimated at approximately $75 to $100 per campground. Cost will vary, depending on number of campgrounds available for calibration. Where season-long records of number of campers using unsupervised campgrounds are available from self-registration or ticket sale records, considerable reduction in data-collection costs may be realized.

Comments: The sampling technique produces estimates of number of camper-nights only, not estimates of hours of use by activity. It can produce precise estimates of number of campers. The 1961 pilot study produced estimates within approximately 10 percent of actual number of campers at a confidence level of 95 percent.

Citation: James, George A., and John L. Rich. 1966. ESTIMATING RECREATION USE ON A COMPLEX OF DEVELOPED SITES. USDA Forest Serv. Res. Note SE-64, 8 pp., illus. SE. Forest Exp. Sta.

What It Does: Produces estimates of visits and use (by activity), and has use updating features, for a test set of developed sites from traffic-count records obtained from one or two locations. In a 1964 pilot test, good estimates of use were obtained for eight developed sites from a vehicular traffic-count record at one key location.

How It Works: Use estimates (by visits, by activity, etc.) are obtained by determining the relationship between traffic counts and the desired statistic by simultaneously measuring both on several developed sites. Analytical procedures, described by James and Ripley *(1963)*, produce season-long estimates of use for individual sites and for all sites combined. The final step is to determine the effectiveness of one or more traffic counters in estimating total seasonal use for all sites combined. The method can also update use estimates on all sites for a several-year period following calibration.

Cost: Average cost per site for first-year calibration is approximately $325 for labor and supervision. One observer can calibrate two sites at one time. Most cost reduction in sampling is not immediate, but comes after the first-year period of calibration. The economic gain lies in the fact that traffic counters need not be installed, maintained, and read periodically on any but the indicator site during the next few-year period.

Comments: The technique provides use estimates for almost any kind of developed site; i.e., the set of sites need not all be campgrounds. The method provides an estimate of number of entries, not a true estimate of number of visits.

Citation: James, George A. 1967. INSTRUCTIONS FOR USING TRAFFIC COUNTERS TO ESTIMATE RECREATION USE SIMULTANEOUSLY ON TWO NONCONTIGUOUS DEVELOPED SITES. Unpublished report, available from Recreation Research Project, Southeastern Forest Experiment Station, Asheville, North Carolina 28802.

What It Does: Designed to produce estimates of amount of use, by activity, on unsupervised developed sites, it makes provision for updating estimates during a several-year period following calibration from vehicle counts only. Good estimates of use were obtained on approximately 12 sites in a 1966 pilot study.

How It Works: Procedures are the same as for the double-sampling technique, but two developed sites are calibrated during the same sampling day. On each sampling day, the observer spends approximately 6 hours on each of two sites, rather than 12 hours on one site. The two sites must be within approximately 15 minutes travel time of each other.

Cost: A single observer can calibrate two sites at one time, thus reducing sampling

costs by approximately 50 percent over the double-sampling technique.

Citation: James, George A., and Gary L. Tyre. 1967. USE OF WATER-METER RECORDS TO ESTIMATE RECREATION VISITS AND USE ON DEVELOPED SITES. USDA Forest Serv. Res. Note SE-73, 3 pp. SE. Forest Exp. Sta.

What It Does: Produces estimates of amount of use, by activity, on unsupervised developed sites and makes provision for updating estimates from water consumption records only during a several-year period following calibration.

How It Works: Procedures are the same as for the double-sampling technique described previously.

Cost: Average cost per site for first-year calibration is approximately $650 for labor and supervision, and approximately $150 for the water meter. If relationships between use and water consumption are strong, estimates can probably be updated for a 3- to 5-year period following calibration, thus reducing sampling costs to approximately $150 to $200 per year.

Comments: Water use on developed sites is generally correlated highly with recreation use. Estimates of use based on water-use records can generally be expected to be more accurate than those based on vehicular traffic counts. Though initial cost of a water meter is higher than that of a pneumatic traffic counter (approximately $150 vs. $75), total site-calibration cost might be less because only one water meter is generally needed per site, or site complex, regardless of the number of site entrances. Compared to traffic counters, water meters are less subject to vandalism, require less maintenance, and are not affected by snow or ice.

Citation: Crapo, Douglas, and Michael Chubb. 1969. RECREATION AREA DAY-USE INVESTIGATION TECHNIQUES: Part 1, A Study of Survey Methodology. Mich. State Univ., Dep. Park and Recreation Resources Tech. Rep. 6, 125 pp. (Available as a reprint from University microfilms, $5.55).

What It Does: A test of various self-administered questionnaire techniques to determine their reliability in collecting information about park-user characteristics, use patterns, attitudes, and opinions.

How It Works: Use parameters were obtained by random-systematic sampling procedures, by a combination of voluntary "hand-in" questionnaire techniques, and by interviewing nonrespondents at eight sample state and regional parks in Michigan. The accuracy of voluntary questionnaire information was high, and estimates of good precision were obtained for the entire park-using population.

Cost: Approximately $11,000 (plus contributed time) to carry out elaborate tests in eight state and regional parks, including field work, analysis, and report preparation.

Comments: Results indicate that by changing questionnaire design, content, and retrieval methods, questionnaire responses and data reliability can be significantly increased. Agencies with contact-station, controlled recreation areas can get good user information on a continuous basis at relatively low cost.

Citation: Wagar, J. Alan. 1969. ESTIMATION OF VISITOR USE FROM SELF-REGISTRATION AT DEVELOPED RECREATION SITES. USDA Forest Serv. Res. Pap. INT-70, 27 pp. Intermount. Forest and Range Exp. Sta.

What It Does: Produces estimates of total visitor use from self-registration data obtained from visitors. In a 1967 pilot study, estimates of total use were as precise as those obtained from an earlier method that required six times the man-hours in sample counting. Estimates are provided for (1) a site the season it is sampled, (2) the same site in subsequent years when no sampling is done, and (3) for a site never sampled but similar to nearby sampled sites.

How It Works: Use information is obtained from visitors through self-registration (predictor variable) and on 24 randomly selected on-the-hour counts

during the recreation season; 12 for daytime, 12 for evening. Regression estimation procedures are used to produce estimates of total use and use by activity. The method can update use estimates for a several-year period following calibration from self-registration information.

Cost: Average cost for first-year calibration is approximately $75 per site. The updating feature reduces cost to approximately $25 to $30 per year over a several-year period for collection of self-registration cards, data preparation, and computer analysis.

Comments: The method can provide good estimates of use at low cost. Information obtained through self-registration includes ZIP Code of individual or group, thus making it possible to determine visitor origin and travel distance between site and visitor origin for self-registration sites where the fee system is enforced.

Citation: Wagar, J. Alan, and Joel F. Thalheimer. 1969. TRIAL RESULTS OF NET COUNT PROCEDURES FOR ESTIMATING VISITOR USE AT DEVELOPED RECREATION SITES. USDA Forest Serv. Res. Note INT-105, 8 pp. Intermount. Forest & Range Exp. Sta.

What It Does: Produces estimates of total visitor use for the usual activities, for occupancy of camp units by daytime and nighttime, and for camping equipment by types. The method was tested with good results for three seasons at a 27-unit campground, and for one season at a recreation complex consisting of 117 camping units, plus picnicking, fishing, boating, a lodge and cabins, and a trail head to an adjacent primitive area. Future usefulness of the method depends on the availability of suitable, reasonably inexpensive counter equipment which is not presently commercially available.

How It Works: The net count system relates randomly scheduled counts of visitor use to mechanical traffic counts for the same times, and applies the resulting relationships to the season-long traffic-count record to obtain an estimate of season-long visitor use. The method differs from the double-sampling technique in that only 20 randomly selected, on-the-hour counts are taken instead of 12 daylong sequences of counts. A traffic counter is used to record the vehicles actually present at specific times rather than one that records the total flow of traffic during a period of time.

Cost: Estimated at approximately $100 to $125 per site for field work, supervision, travel, and servicing of traffic counters. The largest cost is the electric traffic counter, though not presently available commercially, which is expected to cost from $200 to $500.

Comments: The net-count visitor sampling method could be highly effective for selected situations but, as mentioned, it is contingent upon counting equipment that is not commercially available at this time.

Citation: Cordell, Harold K., George A. James, and Russell F. Griffith. 1970. ESTIMATING RECREATION USE AT VISITOR INFORMATION CENTERS. USDA Forest Serv. Res. Pap. SE-69, 8 pp. SE. Forest Exp. Sta.

What It Does: Designed to produce estimates of amount and kind of recreation use at visitor information centers, this makes provision for updating estimates for a several-year period following calibration based on several easily obtained indicators.

How It Works: Information is obtained on 12 randomly selected sampling days concerning number of visitors and use, by activity, which occurs in the visitor center building, along trails, and in the parking lot. Regression-estimation procedures produce use estimates based on such indicators as number of people entering the exhibit hall, vehicle counts, and bus ticket sales.

Cost: Total cost of the 1969 sampling effort was $1,700. The updating feature makes it possible to spread the benefits and costs over several years. Total cost prorated over a 5-year period will average approximately $340 annually.

Comments: The method yields good estimates of seasonal use, by activity, for

almost any kind of visitor information center, including use that occurs in theaters, in parking lots, along trails, etc.

Citation: Elsner, Gary H. 1970. CAMPING USE-AXLE COUNT RELATIONSHIP: ESTIMATION WITH DESIRABLE PROPERTIES. Forest Sci. 16: 493-495.

What It Does: Describes a refinement for increasing the precision and value of use estimates based on the double-sampling technique described by James and Ripley *(1963)*. The method, based on a general nonlinear function, increases the complexity of office computations only slightly.

How It Works: The general model for predicting campground use from axle-count data includes three desired properties: (a) zero intercept, (b) fixed upper limit, and (c) decreasing campground use with increasing axle count.

Cost: Average cost per site for first-year calibration, based on 12 sampling days, is approximately $650 for labor and supervision, and approximately $75 each for pneumatic traffic counters. Use estimates can be updated for a 3- to 5-year period following calibration, thus reducing sampling costs to approximately $150 to $200 per year.

Comments: Estimating use by the nonlinear function requires more information than the ordinary regression formulations. It is necessary to know the number of camping units at each campground, and requires close initial estimates of the remaining parameters. Making these initial estimates can be time-consuming if the analyst has little experience with this particular function.

ESTIMATING USE ON DISPERSED AREAS

Citation: Bury, Richard L., and James W. Hall. 1963. ESTIMATING PAST AND CURRENT ATTENDANCE AT WINTER SPORTS AREAS . . . A PILOT STUDY. USDA Forest Serv. Res. Note PSW-33, 7 pp. Pacific SW. Forest and Range Exp. Sta.

What It Does: Produces estimates of attendance at winter sports areas; makes provision for updating attendance estimates for a several-year period following calibration based on business records of tow-lift tickets or restaurant receipts. In a 1961-62 pilot study, estimates of total attendance over a 2-month period were within 8 percent of true attendance at the 67-percent level of confidence.

How It Works: During a calibration season, an observer counts the number of persons and total number of vehicles on randomly selected days. The average length-of-stay and average number of persons per vehicle are derived from these. These are converted to visitor-days or visitor-hours of use and are correlated with routinely collected daily figures of number of lift and tow tickets issued, restaurant receipts, and receipts from equipment rental obtained from resort operators. Regression and correlation estimation procedures are used to produce estimates of attendance.

Cost: The technique is relatively expensive because one full-time person is required at each entrance (and exit, if visitor-hours are desired) during sampling days of the calibration season. Attendance can be estimated inexpensively for a several-year period after the estimation equations are derived.

Comments: This technique provides estimates of attendance only, not estimates of use by activity. The authors say that the pilot study was useful primarily to illustrate the form of results, to identify problems, and to suggest general levels of attainable precision.

Citation: Cushwa, Charles T., and Burd S. McGinnes. 1964. SAMPLING PROCEDURES AND ESTIMATES OF YEAR-ROUND RECREATION USE ON 100 SQUARE MILES OF THE GEORGE WASHINGTON NATIONAL FOREST. N. Amer. Wildlife & Natur. Resources Conf. Trans. 28 (1963): 457-465. Also: Cushwa, Charles T., Burd S. McGinnes, and Thomas H. Ripley. 1965. FOREST RECREATION ESTIMATES AND PREDICTIONS IN THE NORTH RIVER AREA, GEORGE WASHING-

TON NATIONAL FOREST, VIRGINIA. Va. Agr. Exp. Sta. Bull. 558, 48 pp., illus.

What It Does: A technique for generating estimates of dispersed use on large units of land. In a 1961-62 pilot study, good estimates of number of visits and use, by activity, were obtained for a 100-square-mile section of the George Washington National Forest. In addition, considerable information was obtained about socio-economic characteristics of the forest visitors.

How It Works: Use information was obtained by personally interviewing forest visitors as they departed the area along roads and trails during each of 648 randomly selected sampling periods. The 1-year period for which use estimates were desired was stratified by day of week (weekend days and holidays, and weekdays) and season of year. Exits were stratified into three major groups: paved roads, unpaved roads, and trails. Length of time of sampling unit was adjusted inversely to expected flow of traffic, and varied between 1 and 4 hours. Stratified random-sampling estimation procedures were used to produce year-long estimates of visits and use.

Cost: Although less than 1 percent of all sampling opportunities were sampled, costs were high because of the large number of sampling opportunities available and the large amount of travel involved in interviewing visitors. Total cost of the study is estimated at approximately $8,000. Cost will depend upon size of the area selected, duration of the study, and level of accuracy desired.

Comments: Study results revealed that a stratified random-sampling model (with no prior knowledge of how to optimize sampling effort) can produce good estimates of total and component recreational uses. In addition, the study detected significant relations between users and uses as a basis for providing decisions for present and future recreational management. The pilot study made no provision for testing relationships between use and use indicators on which estimates might be updated annually for a several-year period following calibration.

Citation: James, George A., and Robert A. Harper. 1965. RECREATION USE OF THE OCALA NATIONAL FOREST IN FLORIDA. USDA Forest Serv. Res. Pap. SE-18, 28 pp., illus. SE. Forest Exp. Sta.

What It Does: Produces estimates of amount and kind of use, both mass and dispersed, which occur on areas as large as entire National Forests.

How It Works: Two sampling models were employed to measure visits and hours of use, by activity. The double-sampling technique *(op. cit.)* was used to estimate use on three developed sites. Simple stratified random sampling, which entailed interviewing visitors as they left the forest at established interview checkpoints, was employed to measure all other use. The two sampling techniques, used simultaneously, worked well. In addition, the interviews yielded considerable information about socio-economic characteristics of forest visitors.

Cost: The intensive year-long sampling effort cost approximately $15,000.

Comments: The sampling effort provided a necessary followup test of the already pilot-tested stratified random-sampling technique *(Cushwa and Meginnes 1964)* for estimating use on large areas. Although the model produced good estimates of use, a serious limitation was high cost and inability of the model to update estimates in future years. In subsequent study, James and Henley *(1968)* investigated this feature.

Citation: James, George A. 1968. PILOT TEST OF SAMPLING PROCEDURES FOR ESTIMATING RECREATION USE ON WINTER-SPORTS SITES. USDA Forest Serv. Res. Pap. SE-42, 8 pp. SE. Forest Exp. Sta.

What It Does: Produces estimates of visits and use, by activity, (including difficult-to-measure skiing use) at winter-sports sites. Makes provision for updating use estimates for a several-year period following calibration based on vehicular traffic-count records and such concessioner records as restaurant and ski-lift ticket sales.

How It Works: The recreation season is sampled on approximately 18 randomly

selected days. Daily and season-long records are obtained of restaurant and ski-lift ticket sales and vehicular traffic count. Regression procedures produce use estimates for such variables as number of visitors; amount of skiing and snow-play use; and amount of use occurring in restaurants, lodges, equipment - rental shops, parking lots, etc. A short questionnaire (self-addressed, franked postcard) is administered to determine average hours of skiing per day per skier and other variables of interest.

Cost: Total cost of the 1966-67 pilot study was $1,865, not including the traffic counter ($700) installed at the site entrance. Estimates can be updated annually for a several-year period following calibration, thus reducing average annual cost to approximately $375.

Comments: Each winter-sports site represents a unique sampling situation and the sampling technique must be modified to fit each site. Pneumatic traffic counters do not work in snow and ice; and more expensive counters, such as magnetic loop or electric-eye, must be used to obtain accurate traffic-flow information.

Citation: James, George A., and Robert K. Henley. 1968. SAMPLING PROCEDURES FOR ESTIMATING MASS AND DISPERSED TYPES OF RECREATION USE ON LARGE AREAS. USDA Forest Serv. Res. Pap. SE-31, 15 pp. SE. Forest Exp. Sta.

What It Does: produces estimates of dispersed (and massed) use on large units of land. Makes provision for updating use estimates for a several-year period following calibration based on vehicular traffic-count records. In a 1966 pilot test on the Pacific Ranger District, Eldorado National Forest, in California, use estimates and sampling errors were determined for 37 recreational activities on Forest Service land and for 33 activities occurring on "other" land within District boundaries.

How It Works: A stratified random sampling technique is used which incorporates road checkpoints at which exiting recreationists are interviewed. Interviews are conducted on approximately 20 days during the use season for which estimates are desired. Vehicle counts are obtained mechanically from one or more key roads to establish relationships between use, by activity, and traffic on which estimates might be updated in future years. Use on important developed sites within recreation area boundaries is estimated by the double-sampling technique.

Cost: Cost of the study, not including cost of traffic counters and signs, was $13,700. Use estimates can be updated annually for a several-year period, thus reducing average annual cost to approximately $3,000.

Comments: The sampling model was used successfully on three large areas during 1967, 1968, and 1969. Improved sampling procedures and reduced sampling intensity lowered calibration costs to approximately $6,500 on each site. Although not pilot-tested, the technique can be used to estimate use on snowmobile areas.

Citation: McCurdy, Dwight R. 1970. A MANUAL FOR MEASURING PUBLIC USE ON WILDLANDS—PARKS, FORESTS AND WILDLIFE REFUGES. S. Ill. Univ. Dep. Forest. Pub. 5, 48 pp.

What It Does: Produces estimates of dispersed use on large tracts of land.

How It Works: Estimates are generated by a stratified random-sampling model, stratification including time of day, day of week, and season of year. Roads within the area are patrolled on randomly selected days and times; vehicles are counted; and questionnaires (containing a stamped, self-addressed envelope and a letter explaining the purpose of the study) are placed on the vehicle windshields of area users. Completed and returned questionnaires form the basis for use estimates. Questionnaires should be used every 3 to 5 years so that recreational trends can be accounted for in the estimates. Formulas are included in the publication for producing estimates of use.

Cost: Cost is minimal if a patrol system is already in use by the managing agency.

Comments: The author recommends that the method be used in conjunction with the double-sampling technique described by James and Ripley *(1963)*.

Citation: James, George A., Peter H. Wingle, and James D. Griggs. 1971. ESTIMATING RECREATION USE ON LARGE BODIES OF WATER. USDA Forest Serv. Res. Pap. SE- (in press). SE. Forest Exp. Sta.

What It Does: The sampling model produces estimates of recreation use on large bodies of water, including estimates of number of persons, use by activity, type of boat, number and kind of fish caught, etc. Makes provision for updating use estimates for a several-year period following calibration.

How It Works: Five systematic flights (in light, single-engine aircraft) are made over the water area on each of 10 sample days. On each flight, the aerial observer makes an instantaneous count of all boats on the water. Boaters are interviewed at random times and locations as they return to landing areas. Vehicle counts are obtained on one or more key roads. Simple linear-regression estimation procedures are used to generate estimates of use.

Cost: Cost of sampling two lakes in the pilot test, by aerial and ground observation techniques, was $4,400. Cost prorated over a 5-year period for which use estimates can likely be updated will average approximately $880 annually. The largest cost is for use of aircraft. Cost can be reduced substantially where several water bodies can be observed on each flight, or where the water body is of such size and shape that ground observers (using binoculars) can count number of boats.

Comments: The technique was used successfully during 1969 on two large reservoirs in Tennessee and Pennsylvania.

ESTIMATING USE ON WILDERNESS AREAS

Citation: Lucas, Robert C. 1964. RECREATION USE OF THE QUETICO-SUPERIOR AREA. USDA Forest Serv. Res. Pap. LS-8, 50 pp., illus. Lake States Forest Exp. Sta.

What It Does: Describes a sampling procedure for estimating amount and type of use, overnight accommodations used, and distribution of use on a large area, most of it a roadless canoeing area.

How It Works: A modified roadblock system and interview approach measured use directly at points of concentration on approach routes, rather than over the entire area. A nonrecording-type pneumatic traffic counter was installed at each of six major access checkpoints to obtain a record of vehicular traffic. Motorists were interviewed on 14 randomly selected days at four checkpoints and on 7 days at two additional lightly used points. Estimates were generated from the composition of traffic on sample periods applied to total traffic recorded by the traffic counters for the entire season. For example, if 5 percent of outbound traffic occurred during sample periods, the sample data were multiplied by an expansion factor of 20.0. Error terms were not calculated for use estimates.

Cost: Approximately $3,000 for salaries, travel, and counters. Tabulation and analysis cost about $1,500.

Comments: Details of the sampling design and estimation procedures are available in mimeographed form upon request to the North Central Forest Experiment Station, St. Paul, Minnesota. The system worked well in the study area, but several unusual conditions contributed to its success: almost all the roads dead-ended near the wilderness-type area; nonrecreational traffic was a small part of the total; night traffic was light and could be omitted from the sampling effort without serious bias; and traffic speeds on the roads were low and thus drivers could be easily and safely stopped by one field interviewer.

Citation: Wenger, Wiley D., Jr. 1964. A TEST OF UNMANNED REGISTRATION STATIONS ON WILDERNESS TRAILS: FACTORS INFLUENCING EFFECTIVENESS. USDA Forest Serv. Res. Pap. PNW-16, 48 pp., illus. Also: Wenger, Wiley D., Jr., and H. M. Gregersen. 1964. THE EFFECT OF NONRESPONSE ON REPRESENTATIVENESS OF WILDERNESS REGISTRATION INFORMATION. USDA Forest Serv. Res. Pap. PNW-17, 20 pp., illus.

What It Does: Objectives of the 1961-62 study were to determine if unmanned registration stations might be employed effectively to obtain information from recreationists on wilderness trails, and to test different types of registration boxes, forms, and signs to determine which combination produced the best response.

How It Works: Recreationists were interviewed personally on randomly selected days and locations, uptrail from the registration station, after they had had an opportunity to respond to the signed request to register. Response rate and quality of information varied greatly by type of box, registration form, and wording of sign. The publication contains recommendations concerning placement of stations, type of registration box, registration form, and wording of sign.

Cost: Not available.

Comments: Though Wenger did not convert registration data into use estimates, he concluded that self-registration information could be used effectively for use-estimation purposes. The study was an important contribution to the wilderness use literature and an essential first step in the design of later studies relating to estimation of wilderness use.

Citation: Thorsell, J. W. 1967. WATERTON LAKES NATIONAL PARK VISITOR USE SURVEY, 1966: PART II, WILDERNESS RECREATIONAL USE. Canada Nat. Parks Serv. Planning Recreation Res. Rep. 24, 57 pp. Also: Thorsell, J. W. 1967. RECREATIONAL USE IN WATERTON LAKES NATIONAL PARK. M.A. thesis, Univ. Western Ontario, 1967, 188 pp. (Reference is basis of Chapter V of thesis.)

What It Does: The general survey objective was to assess the patterns of use in the Waterton Lakes National Park and to determine characteristics of park users.

How It Works: Eight unmanned, self-registration boxes and signs were placed in the interior of Waterton Park. Use of trails was calibrated by projections of recorded use (self-registration forms) based on an assumed 75-percent response rate. Additional information on trail use was collected from field observation and discussions with wardens, naturalists, and group camp leaders.

Cost: Allotment of time for the survey amounted to 1 day each week for approximately 11 weeks for data collection and servicing of registration stations. Total cost was approximately $6,500, including all field sampling phases, data analysis, and report preparation and publication.

Comments: The survey demonstrated that unmanned self-registration stations can provide useful information about wilderness use and users, and served as a pilot study for subsequent trail-use surveys on Banff/Yoho National Parks. Error terms could not be calculated because use estimates were based on an assumption that three out of four entering groups complied with registration. Useful information was obtained concerning characteristics of the park visitors.

Citation: Thorsell, J. W. 1968. A TRAIL USE SURVEY, BANFF AND YOHO NATIONAL PARKS, 1967. Canada Nat. Parks Serv. Planning Recreation Res. Rep. 33, 57 pp., illus.

What It Does: Describes methodology for estimating amount, distribution, and season of use and determining characteristics of trail users.

How It Works: Unmanned self-registration stations were placed at 55 locations within the parks. To determine visitor response to the trail registers, six stations were observed from a distance with binoculars without the knowledge of the visitors during a total of 95 hours. A separately conducted survey of roadside campers and motel guests was also taken

to provide a comparative sample with the main study.

Only 35 percent of the visitors registered at the unmanned self-registration stations, a much lower rate than in Wenger's 1961-62 study. Thorsell partially attributes this to the long form used, which contained 19 questions. To obtain estimates of use, registration stations were classified into three rate-of-response groups and registration totals were multiplied by the inverse of the assumed rate of response.

Cost: Response rates of visitors to unmanned registration stations, on which use estimates were based, were determined from 95 hours of binocular observation. Four persons spent 3 months operating and maintaining the 55 registration stations, 45 of which were placed well in the interior of the park. Total cost was approximately $18,000, including all field sampling phases, data analysis, and report preparation and publication.

Comments: The author states that as a result of the study, problems inherent in trail and back-country management can now be defined more easily and a standard base is now available from which future studies will be able to detect trends in use.

Citation: Kovacs, T. J. 1970. SELF-ADMINISTERED PARK VISITOR SURVEY TECHNIQUE. Canadian Outdoor Recreation Demand Study. Canada Nat. Parks Serv. Dep. Indian Affairs and Northern Develop., 23 pp., illus.

What It Does: Describes the park visitor survey technique utilized in the Canadian Outdoor Recreation Demand Study designed to identify and determine the nature of use in all types of parks in Canada and to reveal the characteristics of the users.

How It Works: Employs the self-administered questionnaire method to collect information about park visitors. Questionnaires, distributed to a random sample of visitors at park entrances (at 345 parks), were retrieved by voluntary deposit in collection boxes placed near park exits. The technique proved to be a valuable method for collecting information on park visitors.

Cost: Depending on the type of park surveyed, the cost per completed questionnaire (which includes all costs for the entire project) ranged from 24 cents to $1.42. An overall cost of slightly over $1 per completed questionnaire appears to be a realistic estimate of the expenditure. Over 91,039 completed questionnaires were obtained.

Comments: The technique proved to be a valuable method for collecting information on park visitors. The Canadian National Parks Service recommends that the self-administered survey method, based on the revised (1970) questionnaire format, be utilized continually to maintain standardized, comparable, and up-to-date knowledge of park use and user characteristics in the National Parks of Canada.

Citation: Lucas, Robert C., Hans T. Schreuder, and George A. James. 1971. WILDERNESS USE ESTIMATION: A PILOT TEST OF SAMPLING PROCEDURES ON THE MISSION MOUNTAINS PRIMITIVE AREA IN MONTANA. USDA Forest Serv. Res. Pap. INT- (in press). Intermount. Forest and Range Exp. Sta.

What It Does: The primary objective of the study was to develop and test a sampling design to provide estimates of current wilderness use and to establish relationships between use and several indicators that might be utilized to update estimates in future years, within specifiable levels of precision. Interview and self-registration forms provided considerable information about characteristics of the wilderness user.

How It Works: The basic sampling design was stratified random sampling, with stratification including day of week, season of year (summer/fall), and expected use of trails. Variables of interest were measured by means of a personally administered questionnaire in interviews with groups entering and leaving the trail during 110 randomly selected 2-day

sampling units. Supplementary (covariate) information was obtained by establishing registration stations on each trail and giving entering groups a chance to register and fill out a wilderness registration card. Mechanical counters, placed on some of the most heavily used trails and access roads, provided additional covariate information.

Cost: The calibration cost of $11,500 can be prorated over a several-year period because of relatively strong relationships between registration and interview information. Assuming that relations between use and registration information remain constant, estimates of use can be updated annually for a 3- to 4-year period based on self-registration only, without interviewing entering visitors. Average annual cost for use estimates thus becomes approximately $3,000.

Comments: The study resulted in a useful sampling tool for obtaining estimates of current recreation use on wilderness areas. The sampling model, however, is not yet recommended for general use because of high cost and weaknesses that must be corrected. The study yields information that should make it possible to substantially reduce costs and to improve sampling efficiency in future studies.

Citation: James, George A., and Hans T. Schreuder. 1971. A 1969 PILOT TEST OF SAMPLING PROCEDURES FOR ESTIMATING RECREATION USE OF THE SAN GORGONIO WILDERNESS IN CALIFORNIA. (Proposed for "Journal of Leisure Research.")

What It Does: Pilot test of a sampling model for estimating the amount of dispersed recreation use that occurs on wilderness areas. Prototypes of an experimental electric-eye trail counter were placed on all entrances to determine their effectiveness in estimating use and to determine whether a mechanical count of all persons (and stock) entering and leaving the area might successfully determine user compliance with self-registration.

How It Works: The study was a followup to the 1968 pilot study on the Mission Mountains Primitive Area, and sampling procedures were similar. Information obtained during the 1968 pilot study, however, made it possible to reduce costs substantially because of improved sample allocation and reduced sampling intensity.

Cost: Cost of the test was $4,800, not including cost of the prototype electric-eye counters. With regression equations generated during calibration year, the initial cost of $4,800 can be prorated over a 5-year period based on self-registration information alone. Average annual cost for use estimates thus becomes approximately $1,200, including an annual cost of about $250 for servicing unmanned registration stations.

Comments: The sampling technique produced use estimates of good precision, based on interview and self-registration information. The electric-eye counters did not produce a satisfactory record that could be used for estimation purposes. Notwithstanding failure of the study to furnish a complete test as planned, it still offers valuable evidence that unmanned registration stations and personal interviews of entering groups can provide precise estimates of wilderness use. Other than the relatively high price tag involved, it can be said at this time that a sound sampling technique is available for estimating wilderness use.

MANAGEMENT OF RECREATION INVENTORY INFORMATION

The rapid expansion in recreation use, sites, and facilities has been accompanied by comparable growth in the magnitude and complexity of handling the vast volume of data that have become available. Consider the procedures used by the USDA Forest Service to handle recreation inventory information collected from the lands and waters that it administers. The very size of Forest Service operations, coupled with the complexities involved in multi-

resource management for wood, water, forage, wildlife, and recreation, made a comprehensive inventory system imperative.

For administrative purposes, the land and water resource base of 186 million acres is divided into nine Regions, 130 National Forests, and 767 Ranger Districts—an area equivalent in size to the land surface of France, plus most of Great Britain. More than 97 percent of this land and water complex, which is located in 42 states, is available and used for some form of outdoor recreation. The developed site complex alone has the capacity to accommodate more than 1 million persons at one time for a wide variety of recreation activities.

The Washington Office Division of Recreation and the Southeastern Forest Experiment Station joined forces in 1965 to develop a Servicewide recreation management system. Known as RIM (Recreation Information Management), the system is a computer-oriented approach to the accumulation, storage, manipulation, comparison, retrieval, and display of information about PEOPLE, PLACES, AND THINGS over periods of time. The Division of Recreation, acting with Regions and National Forests, determines the kinds of information needed. A RIM Project, headquartered at Asheville, North Carolina, provides technical advice on how to collect and manage inventory information, and, using computer facilities at the University of Georgia and at Huntsville, Alabama, carries out the data-management process.

The RIM System provides current and meaningful information on the identification, location, condition, and use of each recreation site and area in the National Forest System, currently consisting of over 21,000 different population elements. It stores this information in quantities that would be impractical to manage by manual methods, and virtually eliminates the burdensome and costly compilation of information at all levels above the actual source of data. In effect, it relieves the resource manager from data-manipulation chores and frees him for the important job of USING information by (1) furnishing a reservoir of information upon which management can draw for a current disclosure of the pertinent facts, (2) by assembling information in reports or in other meaningful arrays, and (3) by organizing information so that interrelationships are disclosed.

RIM is a system designed to yield an almost limitless variety of resource information in any array to meet both internal and external needs and requests; and it makes possible the rapid production of lists, summaries, and analytical comparisons that can improve the quality of managerial decisions affecting the allocation of funds and utilization of resources. RIM is designed to retrieve any characteristic or combination of characteristics ever stored in the system.

RIM has been in operation since 1965, and its operational data banks currently include:

1. BASIC ADDRESS (location, identity, size, capacity, access, etc., of all sites and areas by name and serial number)
2. FACILITY INVENTORY (kind and amount of recreation facilities and improvements in place)
3. CONDITION SURVEY (degree that each facility and physical improvement meets existing standards, the cost of routine maintenance, and the cost of any action required to correct unsatisfactory or unacceptable conditions)
4. DIRECTORY (information about campgrounds and picnic grounds, including type of facilities provided, nature of opportunities available, fees, etc.)
5. RECREATION USE (quantity, timing, and location of recorded use on a site-by-site and area-by-area basis)

All data banks are updated annually to provide a perpetual inventory of up-to-date information.

Future RIM data banks will include: (1) a PROGRAM file, which will be an inventory and record of facts about potential sites and areas to assist managers in planning future developments; (2) a HISTORICAL file, which will relate passage of time to physical and environmental changes on sites and areas; (3) a SATELLITE file to create satellite data banks with services closely associated with recreation; and (4) a RESEARCH file, which will be

a source of basic data for studies relating to biological-physical relationships, cost/benefit relationships, supply/demand, use projections, user satisfactions, and others.

Additional information and detailed instructions for implementing the program are found in FSM 2311; RIM Handbook (FSH 2309.11); and Recreation Information Management, In-Service Training Guide, Forest Service, U.S. Department of Agriculture, March 1968, 127 pp.

RIM recognizes some 30 kinds of recreational elements where use takes place; i.e., campgrounds, picnic grounds, swimming sites, winter-sports sites, wilderness areas, trails, waters, etc. Data are stored in the system for each of the approximately 21,000 population elements by approximately 52 activities (camping, hiking, hunting, fishing, etc.). Use input into the system comes from estimates developed for each individual site and area. Use outputs are arrayed to reflect the total amount of use on a particular site or area and the quantity of each type of activity that occurred in that place. Approximately 20 different recreation use summaries and tabulations are produced annually (on a calendar-year basis) and include kinds and volume of use (by activity) and where it occurred (by individual site and area) Servicewide, by Region, by Forest, by District, by population element, by State, by Congressional District, by county, by river basin, by size and capacity of developed site, use by minority groups, and other categories. An example of use information available from RIM is shown in table 1, a Servicewide summary of estimated National Forest recreation use for CY 1970.

Table 1.—*Estimated National Forest recreation use, Servicewide Summary, 1970*

Activity	Public use	
	Visitor-days[1]	Percent
Camping	46,454,100	26.9
Picknicking	7,494,800	4.3
Recreation travel:		
Automobile (33,801,900)		
Scooter & motorcycle (2,139,700)		
Ice & Snowcraft (1,950,400)		
Other machines (130,400)	38,022,400	22.0
Boating		
Powerboats (3,086,800)		
Other boats (1,405,200)	4,492,000	2.6
Games and team sports	578,100	.3
Waterskiing and other water sports	743,100	.4
Swimming and scuba diving	3,459,100	2.0
Winter Sports:		
Skiing (5,515,800)		
Other (1,029,800)	6,545,600	3.8
Fishing	15,239,100	8.8
Hunting	14,308,400	8.3
Hiking and mountain climbing	5,592,300	3.2
Horseback riding	2,387,800	1.4
Resort use	4,082,900	2.4
Organization camp use	4,312,500	2.5
Recreation residence use	7,553,800	4.4
Gathering forest products	1,362,600	.8
Nature study	952,800	.6
Viewing, scenery, sports, environment	7,299,300	4.2
Visitor Information (exhibits, talks, etc.)	1,673,800	1.0
Total	172,554,500	

[1]Recreational use of N.F. land and water that aggregates 12 person-hours. May entail 1 person for 12 hours, 12 persons for 1 hour, or any equivalent combination of individual or group use, either continuous or intermittent.

The 1970 use estimate of 172.5 million visitor-days is composed of a mixture of statistically reliable estimates (where tested sampling techniques were used) and other estimates based on observation, experience, and comparison. The quality and reliability of Forest Service use estimates have increased substantially during the past several-year period because carefully controlled and statistically sound sampling procedures have been used on more and more sites and areas each year. Overall improvement of use estimates will continue as research develops better and cheaper sampling techniques and as these, in turn, provide estimates of use on a larger proportion of population elements.

CONCLUSIONS

We have come a long way during the past 10 years in recreation-use estimation. Many of the sampling models, modified as needed to meet local situations, have universal application. Research on sampling techniques is continuing, and the overall reliability of data in future years will be progressively improved as it becomes possible to apply statistically sound sampling techniques to an increasingly larger proportion of total recreation use.

Yet none of the current sampling techniques is without need for improvement, and much remains to be done. Continuing effort is needed to design and test new techniques and to improve techniques already in use. In addition, there are several kinds of sites and areas for which no sampling experience is available. Sampling models must be developed and tested to cover the gamut of sampling problems that exist. Because mechanical, electrical, and photographic telemetry offers considerable promise for recording several kinds of hard-to-measure recreation use, improvement in operation and reduction in cost of these devices is important. Perhaps the most urgent need lies in substantially reducing sampling cost of tested and new models. The cost of several excellent models is currently too high for general use.

Another very real obstacle is the highly scattered nature of work in this field, and the considerable difficulty staying abreast of new developments. It is difficult even for the researcher in this field, and perhaps next to impossible for most others. There is need to coordinate efforts of the numerous persons and agencies working in this field to avoid duplication of effort.

There is perhaps a need to create a central clearinghouse for publications and reports on use sampling techniques emanating from federal, state, and municipal agencies, universities, foreign governments, and others. A small panel of interested persons might be appointed to keep up with all developments. A standardized reporting format, possibly in the form of a loose-leaf notebook, might be considered for purposes of updating, revising, and amending tested sampling models. I propose the preparation of a "cookbook of use sampling techniques" that would contain detailed instructions for implementing tested and recommended sampling techniques. These suggestions would not be easy to implement, but I firmly believe that the importance of the information clearly warrants a genuine effort in this direction.

Hopefully, the brief description of the Forest Service RIM System will suggest, especially to recreation managers and planners with large and complex holdings, other systems that will enable them and their agencies to maintain a continuing description, with a satisfactory level of precision, of past, present, and future information and relationships between people, places, and things.

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MULTIPLE-USE MANAGEMENT FOR RECREATION IN THE EAST

by ROBERT L. PRAUSA, *Branch Chief, Recreation Management, Eastern Region, Forest Service, U. S. Department of Agriculture, Milwaukee, Wis.*

ABSTRACT. An overview of the complex management problems that confront the administrator of National Forest lands in the eastern United States, with emphasis on the conflicts that occur and will intensify as a result of the many demands for different kinds of recreation opportunities on National Forest System lands. The need to identify and measure the kinds of recreation opportunities these lands can provide is brought out, together with their relationships to lands of other ownership providing other kinds of recreation opportunities.

COMPLEXITY AND DIVERSITY characterize the Eastern Region of the United States. Within each physiographic province there are wide variations in soils, topography, vegetation, water, and climate. Such variations lead to great differences in patterns of land use and in the mixture of manufacturing, mining, and commerce as well as the outdoor recreation opportunities these lands afford.

The East is also characterized by a complex and diverse populace. The trend toward migration from rural to urban living is perhaps greater in this region than anywhere else. Certainly the East has greater life-style contrasts than any other section of the country. Every major city has its affluent suburbs and its ghettos. Some of the rural countryside is made up of pleasant, prosperous farms just one drainage removed from a "tobacco road."

Obviously people living in these varying cultures have differing needs and wants. The ghetto dweller is not nearly as interested in opportunities for outdoor recreation as he is in bettering his living conditions. A worker is not anxious to end air pollution if it also means an end to his job. The affluent suburban dweller wants more and better highways, not only to speed his travel to and from work, thereby giving him more time to recreate, but also to help speed him away from congested areas for a quiet weekend of solitude before hurrying back to the city with its pollution, ulcers, noise, dented fenders, nameless neighbors, and X-rated movies.

THE FOREST LAND

Throughout the heterogeneous mix of development and cultures lie the National Forests of the East. They occupy only 2.6 percent of the land area in the region. Twenty states are included within the bounds of the region, and 13 of them have National Forest lands. One of the most significant statistics having a bearing upon the management of these National Forests is that over half of the population of the United States lives within this area (fig. 1).

Almost every state within the region owns and manages some forest land. Four

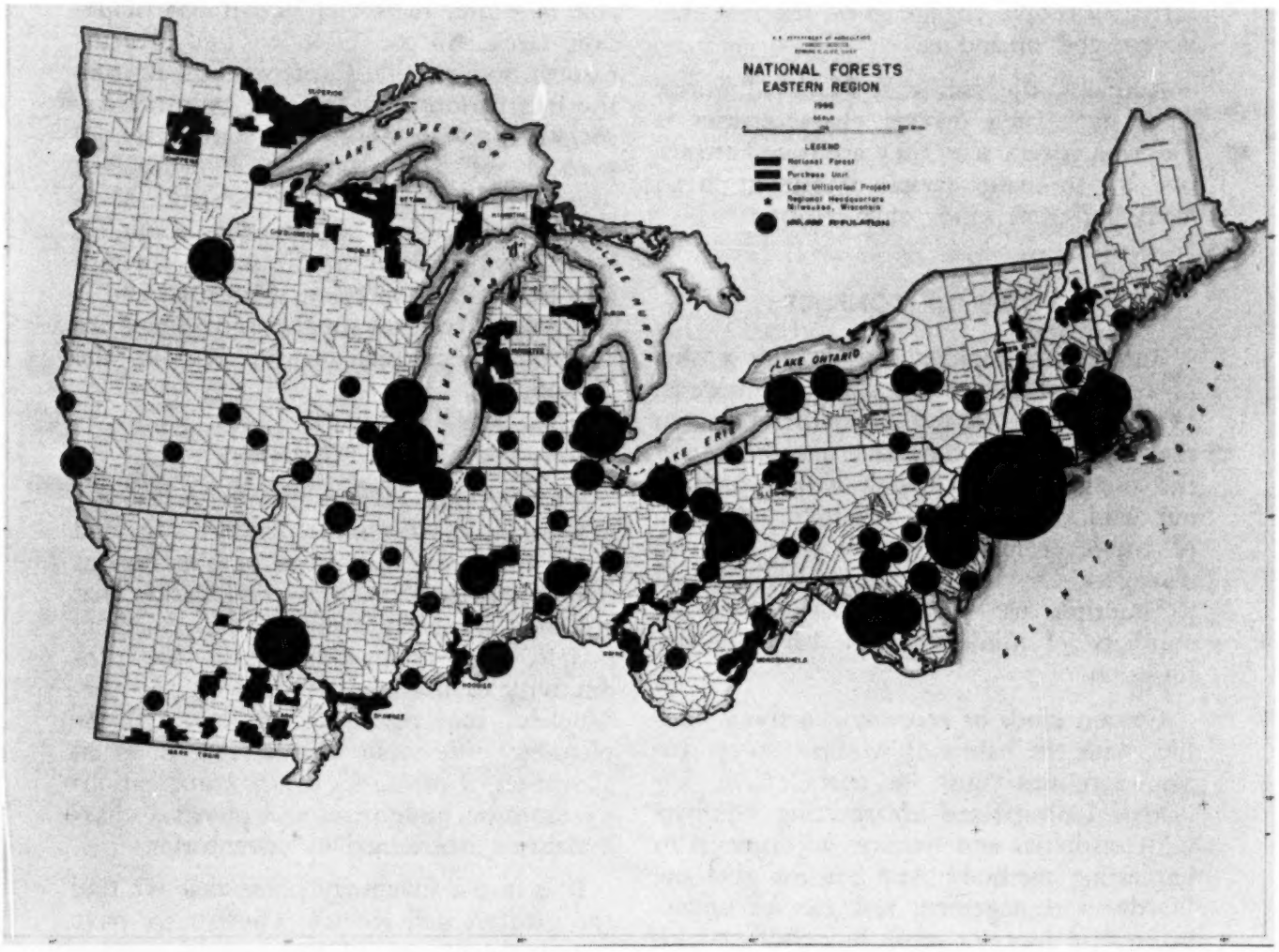

Figure 1.—Population centers in the Eastern Region of the Forest Service. Each circle shows a population of at least 100,000 people— the larger the circle, the greater the population.

(Minnesota, Michigan, New York, and Pennsylvania) each have more than 1 million acres, most of which is forested. Together with local governments, the states in the East control approximately 12 percent of the forested land. This compares with the 6 percent of forested land making up the National Forests. Nine percent, or half again as much, is owned by forest industries, but 70 percent – think of it, nearly ¾—is in private ownership of tracts of less than 500 acres held by some 2,000,000 different owners.

What these statistics mean is that there is a crying need for coordinated resource planning of all forested lands in the East. This is especially true when related to how these lands provide recreation opportunities for the millions of people living in the area.

Over the years, the Forest Service has tried to be all things to all people—especially in providing outdoor recreation. We found a need for large and highly developed campgrounds—so we built them. We responded to the need for wilderness opportunities to the extent we had lands with the characteristics of wilderness. We have done our best to keep pace with the demand for winter-sports activities. Power boating surged in popularity in the late 1950's and 60's, so the Forest Service moved to satisfy demands for recreation opportunities for power boating, water skiing,

and related sports. The list of recreation activities people engage in on the National Forests goes on and on.

Actually, the fact that National Forest lands have such diverse characteristics is the main reason why they are found attractive by so many people interested in so many different kinds of recreation.

A TIME OF CONFLICT

But we are rapidly approaching a time of conflict between these varied interests. We are in the throes of conflict between the harvest of commodity resources and the so called "social amenities" provided on our wild lands. In speaking before a group of top-level Forest Service planners and managers, Dr. Brad Hainesworth referred to multiple use as "the management of conflicts". I think this is a very apt description.

Certain kinds of recreation activity conflict with the habits of wildlife; so recreation activities must be curtailed or adjusted. Unrestricted clearcutting conflicts with aesthetics and requires adjustments in harvesting methods. And the list goes on. Hardly a management task can be undertaken that does not result in a conflict with one or more of other benefits or uses of National Forest lands.

Since the early 1900's major changes in the landscape of the East have been caused by the construction and mining industries. New housing, water impoundments, airports, highways, shopping centers, factories, etc., have made substantial impacts on the forested and other rural lands in this highly concentrated area of population. Also, the region has more surface mining than other regions. Yet the proportion of cropland reverting to woodland is higher than anywhere else except in parts of the South.

Shorter working hours, greater affluence, and improved transportation systems allow more and more people to participate in outdoor recreation. These participation rates are further accelerated through merchandising efforts of manufacturers of sporting equipment, owners of resorts, and real-estate developers. The influence of merchandising has been particularly noticeable in winter recreation activity participation rates. At the October 1968 Northeastern Snowmobile Conference in Boston, the International Snowmobile Industry Association revealed that five states have 70 percent of the Nation's snowmobiles: Michigan, Minnesota, New York, Wisconsin, and Maine, in that order. Contacts with sales personnel for this industry reveal that the same proportion still exists; and if anything, sales rates for these five states are slightly higher than in the rest of the Nation.

MULTIPLE USE

The National Forests are managed under the principles of multiple use and sustained yield to insure utilization of the various renewable resources, in a combination that will best meet the needs of the American people, without impairment of the productivity of the land. If we were to oversimplify the definition of multiple-use planning, we could characterize it as an allocation of resources to use combinations by intuition, judgment, and physical characteristics ascertained by inventories.

It is in the inventory phase that we find the greatest deficiencies. Though we have sound inventories of commercial timber, soil surveys on many areas, and general locations of potential recreation-development sites, there are many serious gaps in our basic resource inventories, especially capacities of the land to provide dispersed recreation opportunities. This paucity of data is serious and could contribute to inaccuracies in planning or management decisions that are improper and irrevocable.

As demands for products and services from National Forest lands increase, we find ourselves faced with what Dr. Marshall Goldman of Wellesley College defines as an "environmental disruption". Dr. Goldman attributes part of our difficulty to the fact that Americans have often been unsure of the goal they were pursuing. Some are seeking purity of air and water; some are concerned only about air; others only about water—without understanding that the environment must be considered as a coordinated whole.

In other words, the ecological system is self-contained. The output of a process becomes the input of a subsequent operation. When one of the outputs is released in such quantities that it cannot be absorbed adequately as an input by other processes, we would normally end up with an environmental disruption. Avoiding such environmental disruptions requires the greatest skill and perception in practicing multiple-use management.

This brings us back to Dr. Hainesworth's definition of multiple use being the management of conflict. I have already referred to one of the conflicts between utilization of a commodity resource and social amenity values. In my opinion, these conflicts—between the use of land by people for recreation and the harvesting of commodity resources—will be temporary. They can and will be solved through more careful land-use planning and by adopting techniques for harvesting commodity resources that are acceptable to the public.

PEOPLE VS. PEOPLE

But there is another conflict that will be much more difficult to resolve. This is what I like to refer to as the people-versus-people conflict. It concerns the conflicts brought about by growth and diversity of various recreation uses of wild lands. Bennie Swift of the National Wildlife Federation said a few years ago, "The recreationist is rapidly overgrazing his pasture and is becoming a greater menace than logging".

Rapidly increasing numbers of residents are purchasing small acreages in rural areas to serve as weekend retreats from noise, air pollution, and the routine daily urban life. Many professional and business people who became interested in ecological development of their properties place a high value on the amenities of the woodland environment. This desire for a contrast with the daily way of life is reflected elsewhere throughout the populace, and more and more people are interested in escaping to what the manager may term a "dispersed environment". People want to get away from the visible effects of man's actions.

This is what accounts for much of the anti-timber harvesting feeling. In responding to this drive, it is important for land managers to carefully plan all uses of wildlands. In speaking at a recreation seminar in Spokane, Washington, last March, Regional Forester Jay Cravens commented on how the recent controversy over timber-harvesting practices on the Monongahela National Forest in West Virginia was a dramatic example of the changing attitudes about resource development. He went on to say that the most significant feature of this West Virginia experience was the way the public "cracked our bureaucratic installation," reaffirming their right to demand action. And through this experience we have also learned that being sensitive to public concern does not necessarily lead to compromise of professional expertise. On the contrary, in most instances, it tends to sharpen it.

We must be concerned not only with how commodity resources are managed on forested lands in relation to the use of these lands for social amenities, but also with the fact that full development of National Forest lands and waters for recreation opportunities in the East may not be in the best public interest.

WILDERNESS

There is only one small classified wilderness in this region—the Great Gulf in New Hampshire. The Boundary Waters Canoe Area, although an element of the Wilderness Preservation System, is not a true wilderness in that motors have been in use there for decades and, even now, are permitted on much of the area; and much of the area has been and is again being logged. There are no other tracts of National Forest land in this region having characteristics that qualify them as potential wilderness as defined by the Wilderness Act.

However, I believe that the majority of the populace in the East would be satisfied with much less than a "pure wilderness experience". In writing in the October 1970 issue of *Current History*, Ken Davis defined wilderness as a frame of mind. Regardless of the precise definition, in the mind of the visitor these are still wilderness experiences. With a few exceptions, the

few remaining tracts of land having the characteristics to provide this kind of recreation experience are within the National Forests of the East. It behooves us to preserve the proper use-capacity of such lands and not to automatically and carelessly respond to public pressure for more campgrounds, more boat ramps, more roads, and other improvements.

An example of one development that I think would be a misguided effort to solve a recreation problem concerns the South Branch of the Potomac River in the Spruce Knobs-Seneca Rocks National Recreation Area. The stretch of this stream from the Smoke Hole to where it leaves the Forest, near Petersburg, is extremely scenic and fine for white-water canoeing. The one campground located in Smoke Hole canyon is literally bursting at the seams every weekend during the summer. Those who are successful in obtaining a camp unit for a summer weekend usually arrive by Thursday evening.

Now, it would be possible to solve this problem of overuse by developing additional campgrounds along a road, downstream. And these campgrounds would be used just as heavily as the present one in Smoke Hole Canyon. But in my opinion, opportunities for a "quality recreation experience" would be sacrificed through such development.

Another example where a response to demand for development could be a mistake is along the Kancamagus Highway in the White Mountain National Forest in New Hampshire. This is a scenic drive that attracts hundreds of thousands of recreation visitors each year, especially in the fall when the leaves have turned color. There are now six campgrounds along the highway. It is close to being overdeveloped at the present time. Any additional development will certainly begin to erode away the scenic quality that this drive was originally designed to enhance.

OVERUSE

It is also necessary to guard against overuse by hikers, cyclists, snowmobilers, indiscriminate campers, fishermen, and canoeists. Also, it will be important to plan for people's use of land and water to avoid conflict or minimize it as much as practicable. There are already examples of such conflicts within the Eastern Region of the Forest Service.

One concerns the use of the Pine River on the Manistee National Forest in Lower Michigan. This stream attracts canoeists of all ages because the current moves swiftly without being dangerous, and the scenery is very attractive. Furthermore, there are eight canoe liveries with 600 canoes located along the upper reaches of the stream. The net result is that, on almost any weekend of the summer, the canoeing use of the stream is so heavy it is impossible for a trout fisherman to fish it during daylight hours. This would not be too serious except that the Pine River produces mainly brown trout, which the avid fisherman seeks in the early morning or late evening fishing hours, and the conflicts so far are not insurmountable.

Figure 2.—No empties to return: just throw 'em in the water or leave 'em on the beach! Ads like this do not discourage littering.

Another example of people-versus-people conflicts is in the Boundary Waters Canoe Area (BWCA). Many people go to this unique area expecting to have a wilderness experience. Upon arriving there they find not only hundreds of similar canoe parties, but motorboats and much other evidence of man's presence. The BWCA is one area where the conflict of people versus people began over 40 years ago.

Figure 2 shows an ad run by Consolidated Can Corporation in *Hunting and Fishing Magazine* in 1936, in which they extolled the virtues of beer in cans and showed how convenient they are because once used they may be simply tossed away. Note that one picture in the ad shows a man in a boat throwing the can into the water. Beginning this year, visitors to the BWCA were prohibited from even having cans or glass containers in their possession.

DILEMMA

In the Sylvania area on the Ottawa National Forest, the Forest Service has been faced with the dilemma of trying to satisfy on one hand the desires of the preservationists who want no development of the area and on the other hand the local residents and other recreationists who would like to see full and complete development —including roads, highly developed sites, resorts, etc. Our final plan of management was not intended to be a compromise, but the result is an area where most recreation visitors can satisfy their particular needs without conflict with one another. Development is concentrated along the northern and western edges of the area (fig. 1), leaving the major acreage undeveloped except for canoe-access camps, hiking trails, and portages. This plan seems to be working out well.

There are other conflicts that must be dealt with in the management of Sylvania, and personnel on the Ottawa National Forest are doing a yeoman job of meeting these conflicts. The original management plan indicated that snowmobiling would be permitted in the area. Many of the groups who would like to see only nonmotorized use of Sylvania objected to this. However, after 2 years when snowmobiling was permitted only on designated trails and adjacent lakes, there was no evidence of real conflict between various users of the area or between this mechanized use and resource productivity. However, there is still room for more refined studies of the effects of snowmobiles on the environment.

A few people have expressed concern about timber harvesting by selection-system cutting in overmature stands in Sylvania. However, one small sale was completed late in 1970; and a person can now traverse this area and not even be aware that it has recently been cut.

Having viewed the status of Sylvania during the past year, I am convinced that it is a fine example of management. There are some things that, using hindsight, we would do differently if we could begin again. But none is really serious although they are noted and are used in adjusting management of not only Sylvania but also other areas.

NEED FOR PLANNING

The problems are really complex. And what about the solutions? Very simply, the answer is good planning. Furthermore, to achieve good planning, there are two related basic necessities: coordination with plans for states, other agencies, and private lands; and the gathering of better data.

Earlier I mentioned the great diversity of land ownership in the Eastern States. All these lands provide some form of recreation for varying segments of the populace. Many of them are being developed to enhance recreation opportunities. Such development on state, county, and municipal lands has accelerated rapidly in recent years as government appropriations have become available under the Land and Water Conservation Fund Act, grants and loans from the Department of Housing and Urban Development, and similar programs.

The recreation opportunities that lands in other ownerships can and do provide are significant, and the management of the National Forest system must complement and not unnecessarily duplicate these opportunities if the total recreation demand is to be met.

The conflicts between users indicate that

forest acres are nonexpandable. What recreation should the Forest Service provide—and for what people? Since the National Forests have the little remaining undeveloped forested lands in the East, it seems readily apparent that management efforts should be directed toward maintaining the capacity to provide the optimum amount of dispersed recreation opportunities.

First, as a general rule, developments should be installed only to enhance these dispersed recreation opportunities. Most of the lands owned privately or by state and local governments are along the major routes of travel or in the vicinity of cities and towns. Consequently they lend themselves better to the development of recreation facilities for the transient visitor. But this is not the total answer, because all lands obviously do not fit this convenient mold. Therefore, the answer is coordinated planning between landowners, analyzing the uses the lands are best suited to provide and then, as the young folks say today, "getting it all together."

Second, we need better statistical and inventory data. We simply do not have an adequate description and measure of the resources. In some areas there is a good timber inventory; we are beginning to get a reasonably good picture of the wildlife population and habitat; a better soils inventory is under way, and water quality is being pinpointed—at least in suspected polluted waters. But there are many gaps in the availability of resource data.

DATA NEEDED

One of the greatest voids in available data is a description of the recreation resource, including measurement of the quality of land and water to provide recreation opportunities. Also, we simply cannot do effective planning without some measurement of the capacity, both social and physical, of these lands and waters to provide quality recreation. Optimum mix of production from all forest resources in any size of ecosystem is not static and requires the best possible scientific management.

The last ten years have provided more meaningful recreation research than ever before; yet these efforts are barely keeping pace with the increase in traditional recreational activities, not to mention activities not even contemplated 20 years ago. Modern technology is producing new forms and means of recreation faster than research can provide data with which the land manager can meet these demands for recreation opportunities.

Snowmobiles, all-terrain vehicles, lightweight motorcycles, and similar recreation vehicles are causing conflicts that will require carefully considered management decisions. Hovercraft are on the horizon, and they may be the recreation vehicle of the future. Yet too many of the decisions being made today in relation to these new recreation pursuits are made on the basis of inadequate study and research. We simply do not have facts.

As the saying goes, "We've come a long way, baby." But renewed efforts are necessary if we are to meet the challenges ahead. The reassuring thing is that no one is giving up. This symposium and other similar efforts will help to make it possible for the administrator of the future to meet problems and opportunities more fully assured that his management will be successful.

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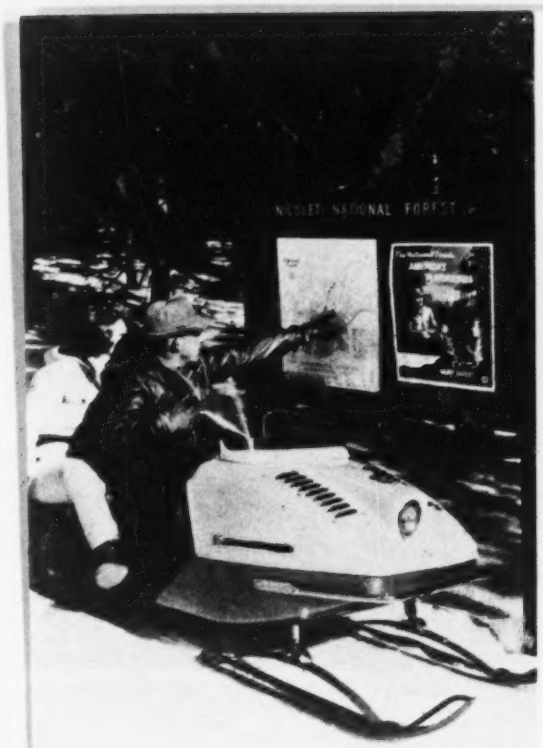
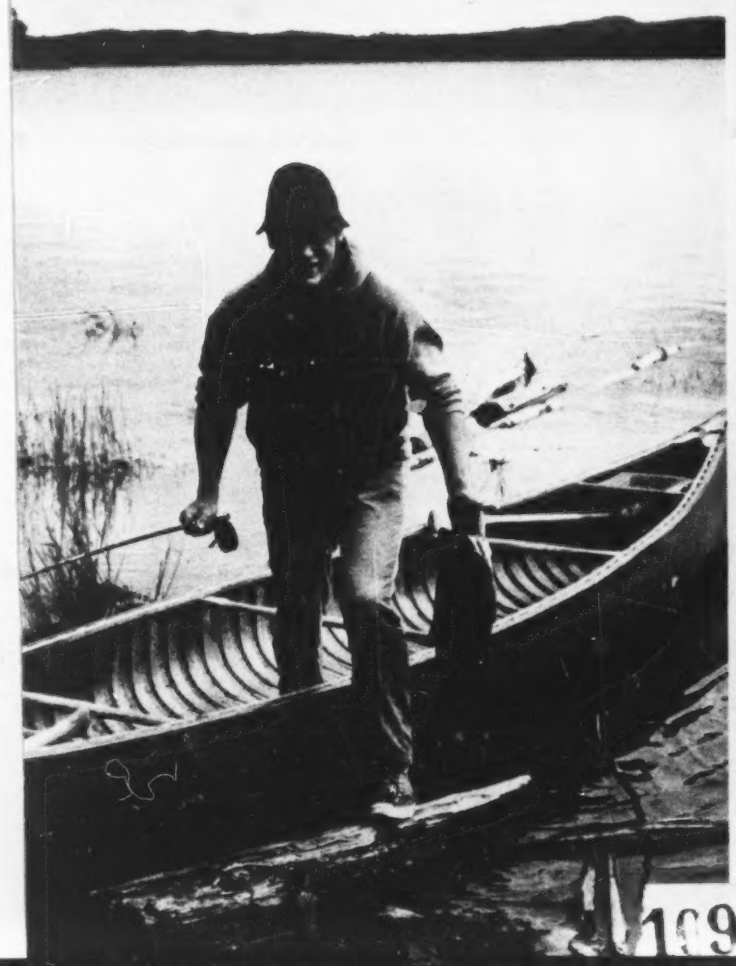


Pocono Mts. Vacation Bureau, Stroudsburg, Pa.

Characterizing the Recreation User

Department of the Interior, National Park Service



THE CAMPER

by GERALD L. COLE *and* BRUCE T. WILKINS, *respectively Associate Professor of Resource Economics, Department of Agriculture and Food Economics, University of Delaware, Newark, Del.; and Assistant Professor of Natural Resources, Natural Resources Department, Cornell University, Ithaca, N. Y.*

ABSTRACT. Camping is one of the fastest growing outdoor recreation activities in the United States. The role of public agencies in providing camping opportunities is outlined. A profile of socioeconomic characteristics of campers is discussed, together with some of the reasons why they camp. Management implications are offered for public-agency personnel, based upon current trends in the camping market and the decision about what kinds of campers should be attracted to public campgrounds.

RAPID GROWTH and change have been characteristic of many forms of outdoor recreation. Few activities have surpassed camping in rapidity of growth, absolute increase in numbers, and changes in equipment. One is tempted to add, "and in changes in the type of person participating"; but time-series research in camping is too scant to permit that.

In 1965 a national survey indicated that more than 14 million persons 12 years and older camp compared with fewer than 11 million 5 years earlier *(ORRRC 1967, 23)*. This 35-percent increase in 5 years surpassed the rate of increase of most activities studied. The 14 million persons represented 10 percent of the studied population in 1965, and indications are that growth has continued. We believe that over 10 percent of our Nation's population camped this past year, and that this proportion will continue to climb in the next decade.

The Bureau of Outdoor Recreation suggests that substantially more camping will be done in the future. They suggest that the 97 million camping occasions in 1965 may increase to 173 million by 1980, a 78-percent increase *(ORRRC 1967, 20)*.

A PUBLIC CONCERN

Camping has some elements that we believe make it particularly interesting when considering the involvement of public agencies in outdoor recreation. One of these has already been noted – camping equipment has changed radically in the past several years.

Years ago, the common camping equipment was the tent–but no longer. Today in most large campgrounds vehicles–trailers, recreation vehicles, tent-trailers, or pickup truck campers–are the most common form of shelter. With these vehicles come demands for hookups for water, electricity, and even sewage disposal. The vehicles used and hookups desired have dramatically altered site facilities requested at campgrounds. This has impacted nearly all public recreational agencies, for those agencies involved in outdoor recreation have typically provided tent sites and tent

facilities. Thus changes in camping equipment place unusually extreme pressures on public agencies.

One might consider the importance to the Forest Service or State Parks of similar radical changes that have occurred in ski-lift design. Those changes have not had as great an impact on agencies, for only occasionally do you provide ski-lifts as part of your recreation program. But historically your agencies have provided not only the lands for camping, but also the facilities; so additional pressures arise when new facilities are needed to meet changing equipment demands.

Another variant of camping from many other forms of outdoor recreation is related to equipment and "style" of camping —the vast range of campsites that may be needed to accommodate the varying interests of people. This interest is frequently reflected in the equipment they take camping.

Consider the range of opportunities people seek in camping compared with other recreation activities such as swimming. It is difficult to envision a range in swimming areas sufficient to encompass the range represented by wilderness campers using natural materials for shelter to the person in a lavish travel vehicle with its own electrical system, stereophonic sound, and television. This wide range in style of camping is rapidly revealed when one attempts to talk of "campers".

It seems appropriate to identify whom we are speaking of when we speak of campers, or at least to identify those we are excluding. A camper means one who camps, specifically one who spends the night in the open or in a structure not closed on all sides, or in a structure moved at least twice a year. Thus trailers, tenters, and those just sleeping under the stars, users of lean-tos, and other similar persons incorporate our view of "campers".

We will focus only on the unorganized camper in this paper. Campers belonging to groups that provide their own camps such as Boy Scouts, private summer camps, and the like form a discreet grouping of campers best studied through examination of the group. If one wants to know about campers at Boy Scout camps, his approach would be to study Boy Scout campers, not all campers.

This view can be extended to campers in less organized situations. Any organization providing camping opportunity may develop a unique clientele. If we view data from the Northwest *(Burch 1965; Burch and Wenger 1967)* or the Midwest *(Brown 1969; Lucas 1970)* or the East *(Carruthers 1966; Roenigk and Cole 1968)*, we see unique aspects throughout. It is this activity, locational, and facility differential that Shafer *(1969)* highlighted in discussing the average camper.

SOCIO-ECONOMIC CHARACTERISTICS OF CAMPERS

From camping studies in the Northeast and elsewhere, a profile of camper characteristics can be assembled. Some caution must be used because most of the camping studies have been biased by being based upon on-site interviews rather than on interviews with campers at their place of residence. Thus the resource base of a particular campground or other attractions in that area has influenced the types of people represented in the sample.

Residence

As a result of the increasing urbanization of the U.S. population, one would expect to find a majority of campers residing in urbanized rather than rural areas. However, Burch and Wenger *(1967)* and Roenigk and Cole *(1968)* concluded that a disproportionate share of campers reside in suburban areas, and center-city residents are underrepresented in the camping population. Place of residence has a high correlation with other socio-economic characteristics; namely, income and occupation. As a result, it is difficult to establish a cause-and-effect relationship between residence and camping.

Another factor should be mentioned: original place of residence versus present place of residence. Persons who were brought up in rural areas and were exposed to outdoor activity have been found more likely to be wilderness-type campers, ac-

cording to Burch and Wenger *(1967)*, reporting on a Forest Service study in the Northwest. Persons with only an urban experience during their childhood were more likely to be easy-access type campers; that is, they utilize campgrounds located along major highways. Thus the impact of place of residence on camping participation is interrelated with numerous factors.

Composition of Party

It has long been assumed that camping is a family activity, and recent studies bear out this conclusion. In the Northeast, Buxton and Delphendahl *(1970)* and Roenigk and Cole *(1968)* found that over 90 percent of the camping parties were families—either individual families or families camping with friends. The mean size of the camping party ranges between four and five persons. Thus camping is primarily a family activity among young adults and heads of households up to approximately 50 years of age with children present in the family. Nonfamily groups of friends accounted for less than 10 percent of camping parties.

Income

Campers tend toward higher incomes than the general population. Buxton and Delphendahl *(1970)*, in a study in Maine, indicated that over one-half of their respondents had annual incomes of more than $10,000. In studies in the early 1960's in New York and Delaware, over one-half of the respondents had incomes of more than $8,000.

Studies to measure income differences between groups of campers preferring different types of facilities have shown that there is no significant difference in income levels. Thus preference for types of facilities and areas—for example, forested area versus beach area or remote wilderness versus easy-access along a highway—indicates that there are no income differences between these groups.

Education

A pattern also is emerging with regard to level of educational attainment among campers versus the general population. Carruthers *(1966)* and Roenigk and Cole *(1968)*, in comparative studies in the Finger Lakes area of New York, the Poconos in Pennsylvania, the Catskill Mountains in New York, and in Delaware, indicated that the mean level of educational attainment was more than 12 years. Burch and Wenger *(1967)*, in a Forest Service study, found that 31 percent of the male campers had some college education, while only about 16 percent of the State's adult male population had attained that level of education. Almost 27 percent of the camper heads of household had done post-graduate work, compared with only 5 percent of the State's adult male population. Bond and Ouellette *(1968)* reported that campers in Massachusetts had a higher level of education than among the general population.

Further analysis reveals differences in educational achievement among groups of campers. In the Forest Service study it was concluded that educational attainment was highest among campers who used both easy-access and wilderness facilities, and lowest among campers who exclusively used the easy-access variety. Roenigk and Cole *(1968)* found in Delaware that the educational level among campers in forested areas was significantly higher than among campers at seashore campgrounds.

Buxton and Delphendahl *(1970)* found that 53 percent of the respondents had completed 1 year of college and 37 percent had graduated from 4 years of college. Only 5 percent of the campers in the sample had less than a high school education. These findings are similar to those derived in a nationwide study done for the Outdoor Recreation Resources Review Commission in 1962.

Occupation

A disproportionate share of campers come from among the professional-technical categories and other responsible positions, including managers and sales persons. A person's occupational status is closely correlated with his educational level. Since campers tend to have a higher educational level than the general population, this is to be expected. Buxton and Delphendahl

(1970) reported that in Maine 46 percent of the respondents were professionals or managers compared to only 25 percent of that occupational grouping among the adult male population. Campers who were farmers, laborers, or service workers were under-represented in the camping population compared to the overall population. This may be related to minimal leisure time or income.

Burch and Wenger *(1967)* found that farmers who camped were more likely to prefer wilderness areas whereas the persons with no rural experience were more likely to camp in the easy-access locations where there were more conveniences. Roenigk and Cole *(1968)* found a higher percentage of professional, technical, and managerial people camping in forested areas compared to seashore areas. In the seashore area a significantly higher percentage of craftsmen, foremen, and laborers was found.

Age of Campers

Participation in various forms of outdoor recreation activity is related to the age of the participant. The Maine study *(Buxton and Delphendahl 1970)* is illustrative of the age distribution found among campers. The age distribution of all persons included in the sample indicated a relatively low proportion in the 13-to-24 age group, most likely due to a high level of interest in other recreational activities among the young persons. Thirty percent of the campers in the Maine study were under 12.

Burch and Wenger (1967) concluded that married males in the age range 30 to 44 were most over-represented in the sample of campers compared to the male age distribution of Oregon's population. About 50 percent of the married campers were in that age group compared to only 34 percent in the State.

Age distribution also was found to be associated with type of camping in Oregon. For example, campers 65 and over were over-represented in the easy-access camping areas, while campers in age group 30 or less were under-represented. Conversely, campers over 65 were under-represented among the wilderness campers, as most of the interest in the remote camping area is among the age group 45 to 64.

Persons with no children were proportionately under-represented among campers. From among age group 25 to 54 the presence of children in the family appears to be an important factor in predisposing one to camping. Hypotheses may be established about the relationship of children in the family and camping. Perhaps parents in this age group want their children to have the outdoor experience, whereas when the children are grown or when no children are present, adults participate in other forms of outdoor recreation activity and use substitute forms of lodging while on vacation and weekend trips.

An important conclusion by Burch and Wenger *(1967)* is the strong possibility that campers tend to shift from one camping style to another during their life cycle, and that perhaps the young to middle-age family groups who prefer wilderness camping may later change to convenience camping as they grow older.

Length of Vacation

Length of vacation has often been cited as an influence on camping participation, because of its influence on leisure time. However, Burch and Wenger *(1967)* found that shorter vacations were not particularly a deterrent to camping participation. In fact, campers with only 1 week of vacation were over-represented in their study, while persons with 3 weeks or more of vacation time were under-represented. Apparently the 2 week period of vacation was the most prevalent, and camping participation by that group was about as could be expected in relation to the proportion of the population.

Bond and Ouellette *(1968)* and Roenigk and Cole *(1968)*, in studies in the Northeast, indicated that campers tend to be very mobile; and even though they might have 1 to 2 weeks or more of vacation, they move about between campgrounds during that time. Another influence in addition to vacation time is weekend activity. The combination of weekend trips and mobile vacation trips with moves between campgrounds resulted in a median length of stay

of approximately 3 nights in the Delaware study and in the Massachusetts study, even though over 70 percent of the campers were found to be on vacation.

WHY PEOPLE CAMP

The reasons why people camp are closely associated with the type of camping area they choose and the experience they expect to find there. Burch and Wenger *(1967)* concluded that campers who chose the wilderness areas desired to have interchange with members of their own camping party but were attempting to avoid association with other campers. In contrast, those who chose the easy-access camping areas were in search of social interchange, which could be found in making new friends from among campers in more crowded areas. This helps to explain the apparent camper satisfaction with small and more crowded campsites, which are often found in private campgrounds, versus the more spacious and often more inaccessible or remote sites located in public campgrounds, including National Forests and some State parks.

Roenigk and Cole *(1968)* compared campers who chose the ocean-beach areas with campers who chose the inland forested areas. The forested-area camper was more likely to choose the area for a weekend of relaxation while the ocean-beach camper was there to enjoy fishing, swimming, and other more active sports.

The reason a person camps is also closely associated with the facilities that he expects to find. A definite pattern that has emerged from studies by the Forest Service in the West, as well as numerous studies in the Northeast, indicates that there are definite facilities that existing campers expect to find in a campground if they are to be happy with their stay and if they are to increase their length of stay beyond 1 or 2 days.

Tops among the facilities expected are swimming areas, either fresh water or salt water. The majority of campers tend to participate in some type of swimming or other water-related activity. Thus it is evident that a campground needs to be located on or near the water to have a wide appeal to campers in today's market. Among current users there is a demand for flush toilets, hot showers, picnic tables, and some type of fireplace or access to a central area for a fire that may be enjoyed during the evening.

Campers in general appear to be relatively well satisfied with the facilities they encounter and the particular type of campground they find. Of course this is heavily influenced by their decision as to where to camp, based upon prior experience or recommendations from friends who have camped at this particular location. Campers were asked to indicate their preference for private versus publicly owned campgrounds in both the Massachusetts study and the Delaware study. In both cases campers indicated that they preferred publicly owned campgrounds. However, numerous reasons were cited for a preference among either type of ownership.

Reasons most often cited in the Massachusetts study for public campgrounds included: (1) they were less expensive and had more uniform rates; (2) they had larger and well-spaced campsites, which minimized the feeling of overcrowding; and (3) they had professional personnel and exhibited a greater degree of excellence relative to management and facility maintenance.

Reasons cited for favoring private campgrounds included: (1) reservations could be made, and the length of stay permitted was longer; (2) private campgrounds provided more luxury facilities and organized recreational programs; (3) they had a friendly or less regulated atmosphere; and (4) camper preference for supporting private enterprise was also noted.

Though persons in the Delaware study frequently stated a preference for public campgrounds, the only available sites were often in private campgrounds, so most campers in that study used those campgrounds.

MANAGEMENT IMPLICATIONS

Though we find these characteristics of campers extremely interesting, we feel that the more important question remains: How should these influence the management of

campgrounds by public agencies? We are timorous in attempting to respond to that question because we do not have the management responsibilities so many of you do. This makes us particularly vulnerable to criticisms of being impractical, but has the advantage of permitting us to more easily raise what could be perplexing and discomforting questions.

The first implication to managers would seem to be that any kind of a campground will be used by some persons! We see as the most important management question not What do people seek from camping? but rather Why does your agency supply camping opportunity? There could be many reasons. Indeed most agencies probably have several objectives in mind when establishing a campground. Before an agency decides what sort of facilities and program will occur at the campground, it seems important to decide what purposes they hope to achieve by providing camping opportunity. A number of possible purposes exist. Let's look at a few of these and the potential management implications resulting from these varied objectives.

It is frequently suggested that camping is provided by public agencies to offer inexpensive lodging areas. If this were the prime objective, a location near heavily traveled roads would seem to be indicated. Facilities could be fairly rustic; privies and dirt roads would suffice. Laundromats would be useful, perhaps necessary.

Some agencies indicate not only inexpensive lodging as an important role but in addition identify a rationale of permitting individuals to get closer to nature. If this is a purpose, then certainly flush toilets would not be needed, but nature talks and trails would. Electricity would not be needed, but interpretive centers would be essential. Swimming pools would be a hindrance, but planting of wildlife foods would be of great benefit.

A different objective and one seldom heard explicitly stated would be to please the "power structure". No agency spells this out as an objective; but to stretch our imaginations, let's see what we would do if this were an important objective. The power structure can be thought of as those persons having power—when they support a proposal it usually wins *(Wilson 1966)*. They tend to be better educated upper-income persons. To accommodate their needs and interests, we would need accommodations for substantial trailers (paved roads and broad roadways with trees trimmed well back). Electricity and individual water hookups would seem a priority item. Bathrooms should have flush toilets, and hot showers would be desirable. A boat mooring or a marina should be nearby; so should golf courses and a swimming area, preferably with a diving board and large beach frontage. These would seem important in providing desirable camping sites for those in the power structure.

Perhaps an agency would be bold enough to say that their objective was to insure that an opportunity for camping be made available for all people. If this were the case, we would suggest that most of the agencies' efforts would be directed not at the physical facilities but rather at *potential* campers. Surely sewer lines, showers, and paved roads do not seem essential in meeting the objective of providing camping opportunity for all people. If we want to insure an opportunity for *all* people, we must meet several criteria. We must have a site where one can camp; but more, we must be certain that people know of this opportunity and even more specifically, know exactly where they can camp. Further, we must be certain that people can get to the campground, and finally we must be assured they have the equipment necessary to camp. If we reflect on this list we quickly see how few public agencies have actively attempted to meet the objective of insuring that an opportunity for camping be made available for all people.

We know of no public land-management agency that has made a serious attempt in this direction. By serious we mean their having devoted extensive resources and efforts to achieving the various components noted above. Let's look at how some agencies do attempt to handle aspects of this objective, and perhaps in this way we can envision what a public agency might do if this were their objective.

For illustration, look at the organized camping groups. For example, the Boy Scouts of America have involved millions of boys in camping. How? They own lands or at least identify lands that scouts can use for camping; thus they insure the opportunity. This, of course, is also done by virtually all of the agencies represented at this conference. Further, the Scouts extensively publicize the existence of these facilities and of their availability to Scouts. Many Federal and State agencies, too, provide extensive notification of the availability and location of their camping areas.

The Scouts, however, find a particular problem in insuring that persons have the opportunity to get to the campsites. Most Scouts are too young to drive; and few areas are close to good public transportation; so there is no way to get to the camping area. The Scouts have overcome this particular problem by providing transportation, in some cases through buses, in other cases through organized car pools—parents driving boys. That agency recognizes that if they say they are going to provide all Scouts an opportunity to camp, that it is a sham, a fake, to suggest this can be done without providing transportation for those members of the potential clientele who cannot themselves provide transportation.

You may feel that this is not a problem faced by the public agencies; but if so, it is apparent that we have not brought up the important differences between campers and the general public. Few people from welfare families are found at campsites. One could argue that this is because those people do not enjoy camping. We doubt that anyone would be bold enough to make such an unsubstantiated assertion.

What is quite clear is that many families, particularly from our urban ghettos, have no way of getting to public campsites. Further, if they were to get there, they would be unable to meet the final criteria we mentioned above—having the necessary equipment. Again, the Boy Scouts recognize that many segments of their public do not have the necessary equipment, so they provide it through communal fashion—the troop or pack owning tents or cooking gear.

Where is the public agency that rents equipment at low cost or perhaps provides it free of charge to welfare families? Approaches to this are made by some agencies that provide trail-side shelters or lean-to's, but clearly this is not an adequate response to the need. We are not arguing that this is the best way to supply equipment to low-income families, nor that it is appropriate for the agencies represented here to do so. We are arguing that, if an agency says they are attempting to provide camping opportunity for all people, such efforts would be a necessary aspect in attaining that objective.

The objective actually selected as appropriate for an agency's campground will influence most management decisions. If our objective is to provide low-cost facilities or opportunity for everyone, then very clearly fees should be set at a low level—in fact one might argue that zero cost would be most appropriate. Note however, that very few facilities would be provided, and these would be extremely rustic. In addition, some mechanism for rationing use of areas would very likely become necessary with these low costs. This might take the form of advanced registration. Clawson *(1968)* has suggested a number of reasons why this form of regulation might have many benefits to the user.

Attempting to implement an objective of providing the opportunity for camping to virtually all people would presumably gain widespread support from the public if our appraisal of attitudes common today is correct. Elevating disadvantaged groups has been identified as an appropriate governmental activity. A wide variety of public programs exist to carry out this function. Some of the programs for low-income groups would doubtless be interested in working cooperatively with land-management agencies to see if recreational opportunities could be enhanced through judicious use of funds for equipment or transportation.

Our general conclusion is that some campers can be attracted to almost any campground. This is particularly true if we are willing to increase the value received by providing extensive facilities and services and yet charge an extremely low cost.

We believe the more important question is not How do we attract the camper? but What camper do we wish to attract? The response to that question will be markedly influenced by the public, the supervisor, and the man on the ground.

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HIKERS AND OTHER TRAIL USERS

by ROBERT C. LUCAS, *Principal Geographer and Project Leader in Wilderness Management Research, Intermountain Forest & Range Experiment Station, Forest Service, U. S. Department of Agriculture, Missoula, Mont.*

ABSTRACT. Trail users seem neglected. Trail systems are limited, largely relics of fire control rather than designed for recreation; and total trail miles are probably declining. On the other hand, participation in various kinds of trail-oriented recreation is substantial and growing. Most activity is for short periods of time close to participants' homes. A varied and diffuse trail system, with an emphasis on opportunities near urban areas, is needed. The research base for planning needs to be strengthened.

THERE ARE MANY kinds of trail users: hikers, horseback riders, bicyclists, motorcyclists, ski tourists, snowshoers, snowmobilers, and all-terrain-vehicle (ATV) riders—and there probably will be some others. Definitions of "trail users" get fuzzy. Some of these trail users spread out from trails into general cross-country travel off trails, while others are found both on rural trails and on city sidewalks, and still others use roads in addition to trails.

What do we know about these users that could help us plan trails and trail systems? How much use is there? What kinds of use? What are the trends? What sorts of people participate, and what are their attitudes about trails and trail use?

THE NEGLECTED HIKER

The more one studies the hiker and other trail users, the more the word "neglect" seems to fit the situation. This is not my feeling alone. President Johnson said in his 1965 Natural Beauty Message: "The forgotten outdoorsmen of today are those who like to walk, hike, ride horseback, bicycle."

Earlier, the Outdoor Recreation Resources Review Commission *(1962)* stated: "It is something of a tribute to Americans that they do as much cycling and walking as they do, for very little has been done to encourage these activities, and a good bit, if inadvertently, to discourage them."

Opportunities for trail travel must be about as limited relative to interest as for any major sort of outdoor recreation. There are only at little over 100,000 miles of trails in the United States *(BOR 1966)*. This is less than 1 yard of trail per U.S. citizen, and only about 50 yards per square mile, Alaska aside. England and Wales together have more miles of rural foot paths and bridleways than the whole U.S. *(Countryside Commission 1970)*. Most of the U.S. trails are relics of past programs, mainly fire protection, rather than the product of any recreation planning. And, despite the 1968 National Trails System Act (P.L. 90-543), there still are few active programs to create truly recreational trails.

There are many adverse trends. Total trail mileage in the U.S. is probably declining. Over half of the U.S. trail mileage is

on National Forests, where trail mileage has dropped over one-third since 1945 as roads replaced trails and aerial fire-fighting techniques led to abandonment of some trails. Suburban and exurban sprawl, limited-access highways, new large airports, and other land-use changes have probably eliminated hiking opportunities, especially on unofficial unmaintained paths. The places where I hiked as a boy have become shopping centers, homes, and barren flood-control dikes. Growing population pressures have resulted in many more "NO TRESPASSING" signs.

Hiking may be neglected because it does not produce any income *(Sargent 1969)* and because it is inconspicuous as a result of being dispersed. In contrast, camping and skiing are concentrated, conspicuous, and often produce income. Hikers also are not as well represented by voluntary organizations as are many other types of recreationists. The hikers either tend to be absorbed in national wilderness-oriented groups or involved in hiking clubs that promote a particular trail or region, such as the Appalachian Trail. In either case there is practically no national pressure for hiking opportunities outside wilderness areas.

The neglect applies to research, also. There are only a handful of studies of trail users or trails, and almost all of these concern the traveler in established wilderness, not the general hiker, horseman, and so on. Because research is so limited, many of my remarks will be subjective judgments and speculations.

A national trails symposium has been announced for June 1971, and will have been held by the time you read this. Perhaps it will kindle enthusiasm for trails and will help overcome the neglect they now suffer.

TRAIL USE

The 1965 Survey of Outdoor Recreation *(BOR 1967)*, especially the unpublished detailed information, is the main source of estimates of participation. This survey covered U.S. citizens 12 years old or older. It covered the summer period in depth, but gathered only limited data for the other seasons of the year.

Hiking, which was defined as "walking of a substantial nature in which a pack containing provisions and/or shelter is carried by at least one member of the party," had almost 10 million estimated participants 12 or older in 1965, or about 7 percent of the population in that age range. The average participant hiked 5 days during the year.

Two other related categories of foot travel were also covered in the survey. "Walking for pleasure" involved about 68 million people or 48 percent of the population, with participants averaging 15 days per year walking. "Walking for pleasure" was defined as "any walk where the primary purpose is pleasure, which has not been included under hiking or nature walks and which lasted 30 minutes or more." "Nature walks" were "walks for the specific purpose of observing plants, birds, or animals and often including the collection of specimens." Nature walks had 20 million participants, 16 percent of the population; and participants averaged 16 days in this activity. It is impossible to add the participation rates for these three foot-travel activities because many of the same people participated in two or all three. Occasions can be added, however; and they total about 1.4 billion for 1 year.

None of the definitions of these activities specify anything about where or on what kind of land the activity takes place. A substantial proportion of the hiking, perhaps 10 to 15 percent, apparently takes place in established wilderness in the National Forests or in the backcountry wilderness of the National Parks, based on some rough calculations with agency use reports, and another 15 to 20 percent of all hiking is on National Forest trails outside wilderness. The National Forests reported 6 million visitor-days of hiking for 1970, most of it outside wilderness.

People were asked about the sorts of occasions on which they participated in each activity, and this information suggests something about place. Most hiking (42 percent) was on 1-day outings from home, which means it must be within a few hours travel of where the hikers live. About 20 percent of the hikes were squeezed into "a

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few available hours" (although this raises some doubts about the consistency of such brief hikes and the definition that requires a pack on the back). Another 20 percent of the hikes took place on vacation trips and 18 percent on overnight trips.

In two Michigan National Forests, 40 percent of the campers reported hiking (which probably included much of what the BOR called "walking for pleasure"), and two-thirds of the campers at campgrounds without trails nearby asked for trails *(Lucas 1970);* so we should not underestimate the value of trails in areas more distant from population centers. Hunters also make good use of trails *(James et al. 1964); James et al. 1969; Wilder 1969).*

We do not know how long these hikes were, in time or miles, or how many involved overnight camping. Obviously, most of them were fairly short, part of a day, and involved only a few miles of hiking. Even in designated wilderness, many hikes are short. An intensive study of recreational use in the Mission Mountains Primitive Area in Montana *(Lucas et al. 1971)* showed over 80 percent of all visitors left the area the same day they entered, although previous official estimates showed 50 percent overnight use. Even much larger wildernesses, which conjure up images of 2-week pack trips, are used substantially for short trips, much more so, relative to long trips, than is generally thought.

Two studies of hikers in the Canadian National Parks in the Rockies *(Thorsell 1967; Thorsell 1968)* showed that around 90 percent of all trail trips (almost all by hikers) were 1-day activities, averaging 4 to 5 hours. Only 11 percent exceeded 5 miles penetration. Even the overnight stays were mostly for only 1 or 2 nights. In the Three Sisters Wilderness, 80 percent of the visits (again, almost all by hikers) were only for a day *(Wenger 1964).* Hendee *(1968)* also reported frequent, short wilderness trips to be characteristic.

The predominance of short trips, usually fairly close to home, is even more characteristic of walking for pleasure and nature walks than it is for hiking.

The large amount of horseback riding is surprising, at least to me. According to the BOR survey, over 11 million people (8 percent of the population) rode horses in 1965, for an average of almost 7 days each. Horse ownership has been climbing rapidly all over the U.S. in recent years. Again, we know nothing about the nature of the riding, how much is done on personal horses, how much at riding academies, resorts, etc., how much is on trails, in arenas, on suburban streets, or on the back 40. Riding is much more of a short-time activity than hiking and walking. "A few available hours" accounted for 48 percent of the rides, and 1-day outings covered another 28 percent. Most of the riding must be done close to home. Where opportunities exist for overnight horse camping, however, it is popular. It is common on the Michigan Hiking and Riding Trail from Lake Michigan to Lake Huron *(Cajucom 1970)* and, of course, it is common in most western wildernesses, and perhaps predominant over hiking in a few.

Bicycling is also big business: 23 million riders (16 percent of the population), and 21 days per participant. Most of this is on city streets, but vacations away from home accounted for 10 percent of the reported bicycling, and overnight recreation trips for 6 percent; so at least some bicycling appears to take place out in the country beyond the home neighborhood.

There are no participation estimates, to my knowledge, for motorbike riders, snowmobilers, cross-country skiers, or other possible trail users. The National Forests reported 2 million visitor-days of snowmobiling in 1970. Equipment sales suggest substantial participation. There were reported to be 600,000 snowmobiles as of 1968 *(Baldwin 1969),* with 280,000 sold that year *(Briggs 1969);* and by April 1970 there were almost half a million registered snowmobiles in Michigan, Wisconsin, and Minnesota alone *(Directional Marketing Co. 1970).* Five hundred thousand motorcycles were sold in 1966 *(Anon. 1966).*

A snowmobile study in Minnesota *(Minn. Dep. Conserv. 1970)* reported that almost all snowmobiling was day-use, averaging 4 hours per outing; 87 percent of the snowmobiling was in the participant's home county, and 28 percent of it was after dark.

TRENDS IN USE

Something of a pedestrian renaissance may be developing, or at least some disenchantment with the automobile. Pedestrian malls are springing up in cities, and temporary closures of streets to cars have been popular in New York, Tokyo, and elsewhere.

This renaissance is reflected in participation in hiking and other similar forms of recreation. Numbers of participants in the 1965 survey were compared to participant figures from a similar 1960 survey. During the 1960-1965 period the 12-year-old and over population grew 8 percent, but hiking by this group increased 26 percent, walking for pleasure grew 57 percent (and became the leading type of outdoor recreation in terms of numbers of occasions), horseback riding climbed 44 percent, and bicycling soared 92 percent. Trends are obviously going up rapidly for snowmobiling, motorcycle riding, ski touring, and so on; but there are no figures. The skiing magazines report a boom in cross-country skiing or ski touring; and the outdoor and mechanics magazines reflect an almost explosive growth in snowmobiles, trail bikes, and various sorts of ATV's.

Projections to 1980 *(BOR* show that hiking grew 78 percent from 1965, walking for pleasure 49 percent, horseback riding 44 percent, and bicycling 32 percent. I would treat all recreation projections cautiously. We do not know enough now to make acceptable projections; but it is clear that these activities are substantial, have been growing rapidly, and are expected to continue to grow in the future. Meanwhile, the trail systems and open spaces necessary for these activities are probably declining slowly.

VISITOR CHARACTERISTICS

What sorts of people are most active in hiking and the other types of trail use? This information is important for making use projections, for planning communications with potential users, for considering possible fees, and for evaluating needs and desires.

Hikers and horseback riders are about evenly divided between males and females, but women and girls outnumber men and boys by small to moderate margins in walking for pleasure, nature walks, and bicycling *(BOR 1967)*.

Young people predominate in all the unmotorized activities. Participation drops sharply as age increases, according to the BOR survey *(1967)*. For hikers, as one example, 19 percent of the 12- to 17-year-olds hiked, 10 percent of the 18 to 24 group, 5 percent of the 25 to 44 group, and only 3 percent of the over-45 group. However, hikers on and around part of the Long Trail in Vermont included substantially more older people *(Sargent 1969)*. Bicycling and horseback riding plummet after the teens: riding drops from 24 percent for the teens to 2 percent for the 45-and-over people, while bicycling drops from 60 percent to 2 percent.

Is this a reflection of declining physical ability? Only in small part, I think. One reason for my belief is that walking for pleasure and taking nature walks, which would be physically difficult for only a few older people, also drop off rapidly. Part of this decline probably is due to changing interests and desires as a result of aging, but much of it is related to history rather than aging. The older people grew up in a different society. Opportunities to develop interests in many sorts of outdoor recreation were more limited than in recent years. Work weeks were longer, travel was less easy, parks and so on were less common, and most important, attitudes about leisure and its use were more restrictive.

Mueller and Gurin *(1962)* reached similar conclusions for outdoor recreation in general, and presented data showing the proportion of people in different age groups who had learned to swim. Most young people knew how to swim; 73 percent of the 18 to 24 class had learned, but only 33 percent of the 65-and-over class knew how to swim. For all people who could swim, participation still declined substantially with age, but only about half as fast as it did for the whole population.

Some of the apparent effect of age may be due to its correlation with other factors, such as income. Income is related to par-

ticipation only at lower levels for most of those activities for which we have data. There is an income threshold, a necessary minimum income; but beyond this level, participation rates are fairly constant. The threshold seems to lie a little below national median income for most activities. Horseback riding is an exception; participation rises steadily with income, reaching a top of 14 percent for the $15,000 to $25,000 category. Horseback riding is obviously more expensive than walking or hiking. Walking need cost nothing, and hiking itself very little—perhaps boots and a small pack. However, access to most hiking areas is difficult without a car, so low income has some logical negative effect.

Snowmobiles and ATV's in particular—and trail motorcycles to a lesser extent—are expensive, often more so than horses. However, the people in middle income categories apparently have the highest participation rates, and snowmobiling seems to appeal largely to blue-collar workers *(Directional Marketing Co. 1970)*. Boaters also have this character, and boating seems to parallel snowmobiling somewhat as another high-speed motorized recreation.

Data on the relationship of race to participation are scanty. The 1965 BOR survey reported no important differences in rates between whites and nonwhites for bicycling or walking for pleasure. Whites had almost twice as high a rate for nature walks. If we could unravel the interrelated social factors, race would probably turn out to have little or no association after education, income, opportunity, and racial barriers had been accounted for.

Education has a strong association with participation for all the trail-related forms of recreation for which data are available, which leaves out the motorized users. More education is associated with more participation in every case, and usually substantially. All the wilderness visitor studies show very high educational levels.

Education seems to bring out interests and help people acquire abilities that lead to more outdoor recreation activity, especially some of the simpler and more contemplative, environment-oriented activities. Nature walks, for example, were participated in at four times as high a rate by college graduates as by people with 8 years or less education, and at more than twice the rate of high school dropouts. Even people with only a few years of college education had half again as high a rate as high school graduates. Perhaps people who are more curious about the natural world are also more likely to continue their educations, but I feel there probably is something about the educational experience that contributes directly and importantly to recreational tastes.

Table 1.—*Percent of population 12 or over that participates in hiking, and miles of public trail relative to area and population, by U. S. Census regions*

Census region	Percent hiking[1] (rank)	Miles of trail[2] (rank)	Miles of trail per 100 square miles (rank)	Miles of trail per 100,000 people[3] (rank)
Northeast	8 (3)	1,957 (6)	2.9 (3)	17 (3)
Middle Atlantic	5 (5)	1,663 (7)	1.6 (4)	5 (8)
East North Central	8 (3)	2,306 (4)	.9 (6)	6 (7)
West North Central	6 (5)	785 (9)	.2 (9)	5 (8)
South Atlantic	3 (9)	4,263 (3)	1.5 (5)	14 (4)
East South Central	6 (5)	1,093 (8)	.6 (7)	9 (6)
West South Central	6 (5)	1,988 (5)	.5 (8)	11 (5)
Mountain	14 (1)	52,355 (1)	6.1 (1)	471 (1)
Pacific	10 (2)	32,027 (2)	3.5 (2)	117 (2)
Total, U. S.	7	98,437	2.7	48

[1]From SURVEY OF OUTDOOR RECREATION, BOR 1965.
[2]From TRAILS FOR AMERICA, BOR 1966.
[3]Based on 1970 census population reports.

Geographical factors are also related to participation rates. For most activities, participation rates are a little higher for people who live in metropolitan areas, in the Census Bureau's Standard Metropolitan Statistical Areas (SMSA). An SMSA is defined to include at least one city over 50,000. Horseback riding is an exception, but the difference is small.

Participation varies greatly from region to region, also. For hiking (table 1) participation rates vary from only 3 percent in the South Atlantic region to 14 percent in the Mountain States. It is impossible to unscramble regional differences in preferences from regional variations in opportunity. Table 1 shows large differences in public trail mileage between regions, in terms of trails as related both to area and to people. The Mountain States lead by far, followed by the Pacific Coast, with the Middle Atlantic and Central States bringing up the rear. Even if preferences were uniform regionally, participation would still vary as a result of these disparities in opportunities. However, four regions that are less well-supplied with trails than the South Atlantic region have participation rates twice as high. Part of this may be related to socio-economic handicaps in this region and part to poor distribution of the trail opportunities.

The Northeast is relatively well-supplied and has a high participation rate. The Middle Atlantic and North Central areas are shorter on trails, but still have substantial participation.

VISITOR ATTITUDES

The objectives or motives of participants, their knowledge of opportunities, and their attitudes about resources, developments, other users, and policies and regulations are all potentially valuable for planning decisions. What are visitors or potential visitors seeking? What sorts of trails would meet different visitors' desires? What level of development is appropriate in what situation? How easy or challenging should different trails be—how long, steep, rough, and so on? What sorts of country are most suitable for trails, and what sorts of attractions should trails lead to? What kinds of users can share trails and what kinds need to be separated?

These relevant questions could be answered by feasible research. However, research has been limited, and most of the questions cannot be answered satisfactorily now. Even where good studies have been conducted, the applicability of the results to different sorts of environments and different sorts of visitors is limited.

All the published hiker studies deal with wilderness situations, or at least substantially wilderness environments. Similar purposes show up in all the studies, from the Adirondacks and White Mountains *(Shafer and Mietz 1969)* to the mountainous West *(Hendee et al. 1968; Univ. Calif. 1962; Merriam 1963; Merriam and Ammons 1967)* and in the Canadian Rockies *(Thorsell 1967 and 1968)* despite the variety of definitions and methods used in the studies. Aesthetic values are tops with hikers; the enjoyment of scenery and contact with the natural environment stand above exercise, socializing with other people, or specific activities such as fishing. The relation to the natural world is more an aesthetic, emotional, or romantic link than an intellectual, educational relationship, although these are also important.

A desire to temporarily get away from civilization and its artifacts and social pressures also emerges from these studies. Simple trails without elaborate facilities are preferred by most wilderness visitors *(Hendee et al. 1968)*.

How much of this aesthetic orientation applies to hikers in nonwilderness environments? Probably a good deal. The Vermont study *(Sargent 1969)* showed similar characteristics and attitudes between hikers there in a semiwild setting and visitors to official wilderness. Furthermore, much of the wilderness hiking was the same sort of rather short day-use activity as hiking in general. In addition, a great many hikers in areas that are not strictly wilderness probably still perceive the environment as substantially wild.

What about the unstudied walkers, bicyclists, motorcyclists, etc.? It is hard to even

speculate, but that is about all we can do. Probably the walkers are similar to hikers. Certainly the distinction between the definitions of the two activities is blurred. Exercise might be more prominent as a purpose for walking than it is for hiking. I would speculate that the mechanized travelers are less scenery- and nature-oriented, more interested in the activity of riding their machines as a game, an end itself, or conversely, in some cases more concerned with trail travel as a means of reaching a destination, usually a fishing spot. Planners need to know what the trail machine users are seeking; it really is not obvious, and such information has major implications for planning for these users. Minnesota snowmobilers expressed strong interest in loop trails *(Minn. Dep. Conserv. 1970)*, but their desires and use patterns need much more study.

Which types of users can share trails? Over half of the hikers in three western wildernesses preferred *not* to meet horsemen *(Stankey 1971)*. There are obvious problems in combining use by hikers and horsemen, especially if use is heavy; and separation has advantages *(Hendee et al. 1968; Wis. Dep. Nat. Resources 1969)*. However, a far more serious incompatibility exists between trail cycles and hikers or horsemen *(Hendee et al. 1968; Univ. Calif. 1962; Merriam 1963; Clay 1966; Wis. Dep. Nat. Resources 1969)*. Some of my own research still in progress also shows this friction clearly. The new ATV's almost surely would provoke even more resentment from hikers and horsemen. The conflict appears one-sided; the mechanized travelers do not mind the foot- or horse-travelers, but the latter dislike the machine-users with fervor. This severe friction was also found between paddling canoeists and users of outboard motors *(Lucas 1964; Lucas and Priddle 1964)*.

The reaction of skiers and snowshoers to snowmobilers is unstudied; but, by extension, I would expect sharp hostility toward the machines and their users by nonmechanized travelers.

Crowding on trails is probably not a serious problem either in terms of visitor satisfaction or trail wear and tear, except in established wilderness. Even in wilderness, satisfaction is usually not reduced much by a few encounters with other groups on the trail, but loss of solitude at campsites does knock down satisfaction *(Stankey 1971)*.

MANAGEMENT IMPLICATIONS

The most obvious and general implication is that a more effective, positive program of planning and managing for trail recreation is badly needed. Use and interest are growing; both seem certain to continue to grow; and opportunities are not keeping up, but, on the contrary, probably are actually declining. Trail systems need and deserve more attention outside established wilderness. Wilderness has its own special role to play, but it cannot and should not become almost the only place to hike because of neglect of other chances. Nonwilderness "trail recreation areas" could fill a real void and provide a great deal of enjoyment for many people better and at lower cost than strict wilderness, and at the same time they could free wilderness to serve the purpose for which it has been established.

The need is for diversity and variety in trail systems *(Wagar 1966)*; long and short, hard and easy, close and far, and for different kinds of users. The greatest need at this time, however, is for day-use opportunities, which must be close to or even inside major population centers. This is clearly the kind of hiking and the sort of location where the demand is greatest and the opportunities are the most limited. Safe bicycle trails are an important part of this need *(Ritter 1966, Crafts 1966)*. The needs of innercity people can be met at this time in our history only by providing opportunities close to home; these citizens lack the mobility to use more distant areas much.

Ingenuity will be needed to find places for trails near cities where little public land is available. Abandoned railroad lines and power line right-of-ways, military reserves, run-down waterfronts, and so on may have potentials.

In contrast, I think we should resist an overfascination with grandiose National Trails running on for hundreds or thou-

sands of miles. These trails have a monumental aura about them, and are impressive on a map. They are an interesting part, but only a small part, of the diverse system needed. They are no substitute for shorter trails near population concentrations or for trail networks in interesting places that may be somewhat more distant from population centers. Private lands, particularly timber-industry lands, are important in this class of opportunities, and could be more so.

Hiker trails should be designed primarily for scenic enjoyment, as an opportunity for aesthetic experiences. Seeking out views, vistas, the enchanting little spots, and environmental variety should predominate over engineering efficiency. The shortest distance need not and generally should not be followed. A good trail does not necessarily have to lead to a specific destination; trails *can* be an end in themselves, although the opposite idea has been expressed *(Brockman 1959)*. Most trails can be fairly simple.

Incompatible trail uses need to be separated more thoroughly. Low-intensity horse and hiker use can be combined many places if necessary, but mechanical travel must be isolated if at all possible *(Griffith 1969; Baldwin 1969; Anon. 1971)*. This makes the planning job bigger and raises costs, but I think the benefits would justify the expense of separation. The alternatives seem to be either banning all mechanized trail travel or allowing it to seriously impair the satisfactions of all other trail users.

Related to the need for separating mechanized travelers, I think someone should challenge irresponsible advertising of trail bikes, ATV's, and snowmobiles. Too many ads glorify conquering nature and ignore the damage done.

For example, one ATV ad says "Even 2- to 3-inch trees topple—just drive right through trees and brush" *(Anon. 1971)*. ATV and trail bike ads show wet meadows being ripped up, mud flying from wheels churning up trails, and slopes so steep they are frightening being mastered—and eroded. Impossible and even illegal images are presented, such as the "sportsman" seated on his trail cycle, shooting a presumably deaf deer. Snomobiles swoop gracefully through a trouble-free Shangri-la where there is never a fence, no posted private land, no protruding tips of growing trees, and no undernourished deer clinging precariously to life until spring rescues them again. I do not see why public recreation officials need to feel obligated to somehow accommodate anything the engineers can concoct and the advertising men can misrepresent.

Planning and building trails takes lots of time and money, but better information about trails could aid people to make better use of existing opportunities, quickly and at modest cost. The would-be hikers (and related recreationists) are often frustrated, I think, by lack of knowledge of places to go. The problem is especially acute in large cities where there is little public land available for hiking nearby. I think much more could be done than has been done to help people find what is available. Maps and guidebooks are available for a few areas. Some are listed at the end of this paper. I know of several good ones for Western States. Perhaps there already are trail guides for the environs of our major cities, but if not, I think they would be a good investment.

Finally, more research is needed. The management programs for trail users are sorely in need of greatly increased emphasis. However, even if funds and other resources were provided, the uncertainties I have discussed here would inevitably produce major mistakes and inefficiencies. And yet these uncertainties are by no means imponderable and intractable puzzles. Researchers have the ability to attack them productively, but the research effort to date has been too small and too scattered. The returns for the American people from good research, which could be implemented in better planning and management, would exceed the costs many fold.

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MEMBERSHIP IN CONSERVATION GROUPS AND OUTDOOR CLUBS

by JOHN C. HENDEE, *Project Leader in Wildland Recreation Research, Pacific Northwest Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, Seattle, Wash.*

ABSTRACT. Conservation groups and outdoor clubs are a major influence on natural resource policy through their articulate members. Different kinds of groups are described – their membership, representativeness, potential growth, multiple memberships, and comparability with other voluntary organizations.

CONSERVATION GROUPS and outdoor clubs are a major influence on forest and recreation policy in the United States. Their influence is reflected in legislation such as the Wilderness Act, new National Parks such as the Redwood and North Cascade, many administrative decisions by government agencies, and growing public awareness of environment.

Managers of public or private natural resources deal with conservation organizations at several levels. Thus knowledge about such groups can contribute to understanding them and can provide a healthy perspective to guide future contacts.

Several questions are pertinent. For example, how does membership in conservation groups and outdoor clubs compare with voluntary affiliations among other segments of society? How many and what kind of conservation organizations are there? What kind of people belong? How many people belong? How do conservationists compare to other political groups? Why do people join conservation organizations and what satisfactions sustain their membership? Do multiple memberships of a few dedicated individuals account for many groups?

These questions cannot be answered precisely, because little research has been done on conservation groups and outdoor clubs. But there has been some study, the results of which frequently contradict some common beliefs about these organizations.

VOLUNTARY ORGANIZATIONS

Conservation groups and outdoor clubs are what social scientists call voluntary organizations. Observers of American society have long marveled at our proliferation of clubs and organizations. Voluntary organizations have been noted for several beneficial effects. They allow for expression of a wide variety of interests and values while uniting their proponents; they perform services to society in religion, science, health and welfare, art, recreation, education, and politics; and they influence the legislative process in almost every field. Through multiple memberships they cut across related interests, thus reducing divisiveness in society. They help reduce explosive social tension by providing outlets for expression, providing interaction between social classes, adding to the richness of our culture by preserving traditional

values, and teaching and implementing democratic processes. They provide a potential means of social control that can be used (for good or bad) to communicate ideas and values to a large part of society in relatively short time. They have been noted as a major barrier to totalitarian mass movements and as a pathway to political participation for disadvantaged groups.

National surveys suggest that between one-third and one-half of the population belong to voluntary organizations. Most members of these groups tend to be higher than average in social class as measured by education, income, and occupational classification.

In general, members of organized interest groups tend to differ in some of their characteristics from persons who do not join such groups.

CONSERVATION GROUPS AND OUTDOOR CLUBS

How Many Groups?

The diversity and scope of voluntary organizations falling under the category of conservation groups and outdoor clubs have been illustrated by recent studies in the Pacific Northwest. A survey of wilderness visitors revealed that about 400 respondents belonged to one or more conservation groups or outdoor clubs, representing 218 different organizations *(Hendee et al. 1968)*. A subsequent survey of car campers and wilderness visitors in Washington revealed membership by about 500 respondents in 258 different conservation groups or outdoor clubs. The organizations to which these recreationists belonged ranged from small activity-oriented groups (boating, fishing, rock collecting, etc.) to large national organizations (Sierra Club and Wilderness Society) that are strongly issue-oriented.

As these data imply, the network of groups and clubs is extensive, far more so than most people imagine. Many observers of the conservation movement tend to focus exclusively on large national organizations and forget the many small groups who locally express preferences for particular outdoor activities. When professional resource managers and conservation leaders were asked to estimate the number of groups encountered in our studies of recreationists in the Pacific Northwest, both grossly underestimated the number of existing organizations, although many overestimated the proportion of recreationists they thought might belong to such organizations.

What Kind of Organizations?

Sociologists frequently classify voluntary organizations as either "instrumental" or "expressive" groups depending on their goals. This fits conservation groups and outdoor clubs rather well. Instrumental organizations pursue activities primarily as a means of achieving some goal such as preservation of natural resources. For example, Friends of the Earth and the Audubon Society. Expressive organizations pursue activities for their own sake, such as specific types of recreation; for example, Washington Duck Hunters and Washington Fold Boat Club.

Although the instrumental-expressive dichotomy refers primarily to organizational goals, it may also describe the orientation of member participation. For example, the businessman who joins a country club to improve business contacts is instrumentally oriented in an essentially expressive organization. And the "little old lady in tennis shoes" may be expressively involved in an instrumentally-oriented conservation group activity.

Outdoor clubs typically promote conservation group activities, provide recreational facilities for members, and encourage the enjoyment of certain activities through educational programs. When these organizations do become instrumentally involved in conservation, they typically focus on protection of environments directly tied to those outdoor activities sponsored by the club. For example, kayak clubs support wild rivers; hiking clubs support wilderness. Likewise, some instrumental organizations sponsor expressive activities to attract participation in their preservation endeavors. For example, a Sierra Club official explained to me that one purpose of their outings was to get people acquainted with wild country

so they will learn to love it and be willing to fight for it.

Another typology of conservation groups and outdoor clubs might be: (1) national preservation groups, (2) regional and local preservation groups, and (3) outdoor activity clubs, which are usually local although they may have national affiliations. National preservation groups continuously promote environmental preservation on a large front, such as by the Sierra Club, the National Wildlife Federation, and the Wilderness Society. Regional or local preservation groups tend to evolve by seeking preservation of some specific area such as the North Cascades, the Three Sisters, and the Alpine Lakes.

Who and How Many?

Studies indicate that many members of conservation groups and outdoor clubs live in urban areas and are well above average in education, income, and occupational classification. In general, education seems to most sharply distinguish membership: those belonging to instrumental conservation groups tend to be of a slightly higher educational level than members of expressive outdoor clubs. Members of such organizations are more highly educated than outdoor recreationists in general, who are also well educated. One study of the Sierra Club found that 75 percent had college degrees and nearly 40 percent hold advanced degrees *(Devall 1970)*. In our two studies in the Northwest, 60 percent of the conservation group and outdoor club members had college degrees and 40 percent had done at least some postgraduate work.

However, members of conservation groups and outdoor clubs are not representative of all outdoor recreationists. We determined that about 20 percent of the wilderness users and 10 percent of the car campers in the Northwest belong to either a conservation group or an outdoor club. Based on these data and the known proportion of the public who are recreationists, a very rough projection suggests that less than 1 percent of the total population belong to conservation groups or outdoor clubs *(Hendee et al. 1969)*. These conclusions have important implications for resource managers in that, while such groups are not representative of all recreationists, they may often be so considered by resource managers with whom they have contact *(Hendee and Harris 1970)*.

CONSERVATIONISTS IN AMERICAN DEMOCRACY

The accomplishments of conservationists are remarkable in view of the relatively small portion of the total population involved. Opponents wail, "Never has so much been set aside for so few." Another perspective suggests that, like other social movements, a relatively few activists lead a passive but generally concerned public. The 2 or 3 million organized conservationists do constitute an important political entity. They may be merely "the tip of the iceberg" and thus justify their activity in terms of the long-range interests of the general public.

That organized conservationists and recreationists are not representative of the entire population is clear. However, they do get public attention, are articulate in their appeals for public support, and have demonstrated their political effectiveness. Certainly their social class position contributes to their effectiveness, but the more critical question is whether organized conservationists are any less representative of the general population than other organized political activist groups representing other interests. They probably are not, since the highly educated professional and managerial segment of the public is the most involved in the political decision-making process on almost all issues.

Despite the social-class bias of conservationists, they are, in one respect, more representative than many other politically successful lobby groups in that their strength is based on human rather than financial resources. Whereas most industries lobby on the strength of money provided as an essential cost of doing business, the conservation movement is sustained primarily by individual contributions of time and money by members of instrumental conservation groups.

Like few other movements in a democratic society, conservationists have shown

that a dedicated and vocal minority with relatively meager financial resources can influence legislation. Although some earlier successes are notable, only recently has Congress become highly responsive to the growing preservationist philosophy. In the past, a few partisan alliances, extremely limited financial resources, and an unwillingness to negotiate handicapped the political power of conservationists. Alliances with powerful leaders in the Senate and acceptance of political compromise have been factors in recent legislative successes. Since the reputation of conservationists as "uncompromising Jeremiahs" is well founded, these recent successes may suggest a significant political awakening and increased appeal and acceptability of the movement among politicians.

WILL MEMBERSHIP INCREASE?

Some of the most interesting and important questions about conservation groups and outdoor clubs concern the growth and maintenance of membership. How does membership in such organizations come about? What sustains interest? Will future membership increase? If so, in what types of organizations? These questions have obvious implications for natural resource policy.

The well-established correlation between membership in conservation organizations and higher education implies that membership will increase as educational levels rise. A correlation between membership and urbanization may hold similar implications for growth. Conservation organization membership is increasing. The Sierra Club, with membership now over 110,000, has grown about 20 percent annually for several years.

In studying how people get involved with these organizations, we interviewed members of several groups and found a common steppingstone sequence – from membership in expressive activity clubs to membership in instrumental preservation organizations. The evidence suggests that membership in a politically active preservation group is often preceded by affiliation with an activity-oriented group where certain values and environmental perspectives are learned. If this experience results in an urge to do more to protect the environment and spread the value system, an obvious sequel is to join a more powerful group dedicated, not just to enjoying activities, but to crusading for protection of environmental values. To the extent that it is valid, this steppingstone hypothesis suggests further growth among the preservation-oriented groups from the widespread outdoor clubs.

On the other hand, Devall *(1970)* suggests that preservation activist organizations, such as the Sierra Club, may recruit people not previously associated with outdoor activity clubs. These contradictory interpretations suggest that more study is needed.

The upsurge of interest on college campuses about environmental issues has no doubt had a substantial impact on organizational membership. Although a forest industry-sponsored essay *(Benneth 1967)* suggests a deliberate attempt by preservation groups to recruit college students, it seems unlikely that this is necessary. In a survey at the University of Oregon, 90 percent of the students indicated "moderate" or "great" interest in environmental issues and 75 percent indicated that they "strongly approve" of the environmental movement. (Richard P. Gale and Riley E. Dunlap. Attitudes of University of Oregon students toward environmental issues: a preliminary report. Dep. Sociology, Univ. Oregon, Eugene. 7 p.)

Comparison of the environmental movement with the civil rights movement indicates some similarities, particularly with signs of evolution from politics to protest among conservationists. (Gale, Richard P. From sit in to hike in: a comparison of the civil rights and environmental movements. Paper presented to Nat. Res. Sec. Rural Sociol. Soc. Wash. 16 p. 1970.) Increasing fervor in the environmental movement may be a significant attraction to college students and some other potential members.

Other significant attractions for membership are sociability benefits, which were interpreted as the primary rewards for membership in the Mazamas on the basis of an extensive study of this Oregon group

(*Harry 1967*). For example, the study found that the Mizamas served as a marriage market for about one-third of its unmarried adult members.

No doubt there are other explanations for increasing and maintaining of membership in conservation groups and outdoor clubs. Further research is needed to explain processes by which people develop commitment to preservation ideologies and affiliations with related organizations.

MULTIPLE MEMBERSHIP

There is multiple membership among conservation groups and outdoor clubs, just as a relatively few persons (15 percent) account for a large proportion of memberships (50 percent in voluntary organizations in general (*Wright and Hyman 1958*). Among recreationists, we found that 40 percent of the members belonged to two or more groups and accounted for 66 percent of all memberships reported. The 15 percent who belonged to three or more groups accounted for one-third of all memberships. Devall (*1970*) found that only 21 percent of the members but 57 percent of the leaders of the Sierra Club were active in other conservation groups or clubs. These findings suggest that a small cadre of active conservationists provides liaison and coordination to the movement and a conspicuous appearance of multiple membership.

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HUNTER-FISHERMAN CHARACTERISTICS: FACTORS IN WILDLIFE MANAGEMENT AND POLICY DECISIONS

by ROBERT S. BOND *and* JAMES C. WHITTAKER, *respectively Associate Professor of Forestry Economics, University of Massachusetts Department of Forestry and Wildlife Management, Amherst, Mass.; and Assistant Professor, University of Maine School of Forest Resources, Orono, Maine.*

ABSTRACT. Research on the characteristics and motivations of hunters and fishermen is examined for factors important to resource managers and policy-makers. Characteristics related to the learning experience, time for participation, utilization and accessibility of the resource base, and the type of fish and game harvested are considered. Motivational research, although in its infancy, suggests that participation in these sport activities has importance other than for only the taking of fish or game. In-depth motivation research is needed.

DURING THE PAST decade researchers associated with land and water resources have focused attention more and more on the so-called outdoor recreationist. Social scientists, especially those with an undergraduate education in, or a casual acquaintance with, one of these resources, have conducted research to study participants in one of many activities—camping, hiking, boating, skiing, hunting and fishing. The impetus for this work gained momentum with publication of the Outdoor Recreation Resource Review Commission's reports, some of which dealt with participants in recreation in general and others with particular activities.

Many recreation-participant studies have described the characteristics of the user in terms of socio-economic, demographic, and participation criteria. These criteria are analyzed by correlating a variety of dependent factors against certain independent ones, usually showing some interesting associations. Interesting to whom? As recreation researchers—campers, hunters, fishermen—we have often considered this question.

In our association with the regional technical committee that undertook a "Consumer Analysis of Forest-Oriented Outdoor Recreation Activities in the Northeast," (N.E.M. 35), we were called upon in the annual reports to indicate the usefulness of the findings. This is always a challenge! Most of us resorted to the rationale that the information collected and presented about the characteristics of hunters and fishermen is useful to managers and policy-makers. We have never been asked to prove this contention – and would probably have a difficult time to do so. The most objective proof derives from requests for publications.

Future managers and policy-makers will

benefit by studies similar to those done by the NEM. 35 Committee because they serve as landmarks with which later studies can be compared. The value of data-assimilating research is sometimes questioned because it lacks depth. On the other hand, it is well to know the situations existing at various points in time and thereby to be able to predict trends.

It may be presumptuous of us—because we are not in the position of manager or policy-maker, nor are we trained in resource professions dealing directly with wildlife or fish—to attempt an examination of the utility of knowledge about characteristics of hunters and fishermen as they relate to management and planning. However, it may be helpful to those of you who are in this position to have our views on the manner by which we perceive how information from studies of hunter-fisherman characteristics may be interpreted.

The research on which much of this paper is based was done by an interdisciplinary group from six Northeastern States —New York, Maine, Massachusetts, Pennsylvania, Vermont, and West Virginia. Economists with agricultural and forestry backgrounds, a rural sociologist, and a wildlife biologist comprised the committee. The diversity of outlook, although a deterrent to the development in one sense, proved valuable in the long run. Our views have been influenced by varied disciplines.

CHARACTERISTICS

Consider some of the characteristics about which information has been gathered, and what possible meaning they have to the policy-maker. The statistics we have are from the hunter-fisherman phase of N.E.M. 35 *(Bevins et al. 1968)*. Four general areas of knowledge about hunters and fishermen are: the learning experience, time for participation, utilization and accessibility of the resource base, and type of fish and game harvested.

Learning Experience

A number of sociologists have shown that, if people participate in a recreational activity, they learned to do it at a young age. Mead (1953) "a thousand case studies of adults with recreation skills indicate that many skills were established before the age of 10 and fully 90 percent before the age of 14."

We found that the average hunter was 38 years old and the average fisherman 40. The average number of years that they had participated was 21 and 26 years respectively. This means that, on the average, hunters learned this sport at 17 and fishermen at 14. It should be pointed out that hunting is precluded by law before a certain minimum age, which varies by state.

We found that 84 percent of the hunters and 93 percent of the fishermen participated in these activities in their youth (16 years or younger). Hunters, on the average, participated alone at the age of 16 years and fishermen at 13 years.

These statistics seem to verify the early learning experience contention. Admittedly, we have no knowledge about those people who no longer hunt or fish but did so in their youth. To make these statistics relevant to the manager and policy-maker we need to consider other characteristics known about these sportsmen.

One of these factors is the source of learning. For both hunters and fishermen, 70 percent were introduced to this activity by a parent or other relative. Asked if they took any children under 16 years of age with them to participate in these activities during 1965, 27 percent of the hunters said they did and so did 39 percent of the fishermen. Parents and relatives will undoubtedly have an increasingly less important role in introducing children to hunting and fishing as they reside in urban areas where the resource base is not as easily accessible.

Another characteristic needs consideration: the rurality of residence during childhood. Seventy-two percent of the hunters and 68 percent of fishermen said they spent most of their childhood in a rural area. It is difficult to define a rural area, and obviously there is some relativity involved in the individual's interpretation. We can only assume that although rural Massachusetts and Maine, as extremes, are different, they each offered about the same opportunity to hunt and fish. Seventy-eight percent of the Maine hunters spent their childhood in a

rural area as compared with 67 percent of those in Massachusetts. For fishermen the percentages were 72 and 62 respectively.

Evidence for the apparent importance of a rural background in youth as a commitment to hunting and fishing can be observed from Maine and Massachusetts findings. Different percentages of rural backgrounds were found for persons in Maine who hunted only, 77 percent; fished only, 64 percent; and both hunted and fished, 83 percent. In Massachusetts a similar relationship held true: hunted only, 58 percent; fished only, 54 percent; and both hunted and fished, 69 percent. A greater proportion of people who participate in both sports came from rural areas during childhood, thus indicating the greater influence of a rural background to the combination activity.

The thing about rurality that is important is the number of people today who are living in a rural situation. The statistics are roughly the inverse of what were found for hunters and fishermen: today 70 percent of the population is urban. Projections for future populations are that the Nation as a whole will be 75 to 80 percent urban within the century.

Obviously the learning experience in hunting and fishing is going to be considerably different for much of today's youth and those of the future than in the past. The opportunity, and thus the desire to participate, in such sporting activities will encompass a diminishing segment of the population. This is already evidenced in the declining rate of increase in license sales over the past few years in a state such as Massachusetts. If one assumes a desire to maintain a high level of interest in hunting and fishing for the many benefits one can attribute to them, a method of fostering the learning experience of urban and suburban youth may be required.

Until the present, fish and game managers and policy-makers have focused their attention primarily on providing game and fish. They have emphasized the biological aspects of perpetuating the species. Future emphasis on the user of the resource, whether he hunts or fishes or simply observes, is going to require a reorientation in decisions relating to management and policy-making.

Time for Participation

When and how much time is devoted to hunting and fishing by today's sportsman? About three-quarters of our respondents said that they would like to hunt or fish more than they do, and that for hunters (we did not ask fishermen) time was the most frequently mentioned constraint; 79 percent so indicated.

Approximately one-third of the respondents for each sport worked more than a 40-hour week. Three-fifths had a Saturday-Sunday days-off pattern, about one-sixth reporting only Sunday free during the normal work week. Therefore, slightly over three-fourths of the respondents had only weekends for these activities unless they lived close enough to the resource to enable them to do so before or after work.

It might be assumed that because weekends are the predominant leisure time, an effort would be made by hunters to have Sunday hunting legalized. Maine nonresident sportsmen were asked if they favored Sunday hunting; 44 percent did, 28 percent did not, and 28 percent did not answer. Of those not answering, 84 percent were fishermen only. Because Sunday hunting would facilitate participation by nonresidents, greater support could have been anticipated for this question.

Three-fourths of the hunters and fishermen took vacations. These varied in length, a third having 10 days or less and a third having 21 days or more. Important to the vacation statistic is the degree of use of this vacation for hunting or fishing. Forty-one percent of the hunters used some portion of their vacation to hunt, and 55 percent of the fishermen used part of it to fish. The greater activity by fishermen is related to the concurrency of vacation time and fishing season. Also, fishing is more closely tied to activities enjoyed by families, such as swimming and boating.

If a hunter uses vacation time to hunt, he will devote more hours to it than the fisherman will to fishing. The lesser time spent by fishermen probably reflects family involvement and the need to share vacation

time activities. The hunter may expressly take a vacation to go hunting and not be accompanied by his family.

These findings imply two things for the resource manager. First, an effort is needed to make the resource more readily available. Second, applicable only to hunting, is that where Sunday hunting is excluded, changing the law would provide more time to the hunter during existing seasons. In the six participating states, only Vermont and certain rural New York counties allowed it. Another way of achieving more time would be to extend seasons, but this might not be feasible on a supply-and-demand basis. In fact, simply permitting Sunday hunting might require curtailing the length of season in order to perpetuate certain game species.

The question of satisfying demand is foremost; yet there is good reason for close regulation. Obviously the hunter cannot have all the time he would like to have for hunting. In Maine and Massachusetts there is perennial legislation before the Legislature to permit Sunday hunting. It is inevitably defeated, but not from the rationale of perpetuating game species.

Utilization and Accessibility of Resource Base

A relatively small proportion of hunters (25 percent) and fishermen (20 percent) belonged to a sportsman's group. Of those that did, about one-third were in a club or group that owned land for hunting or fishing; and 20 percent of the hunters and 10 percent of the fishermen were members of clubs that leased lands for these purposes. Only 6 percent of the hunters reported using club lands to hunt.

As might be expected, individual land ownership for hunting purposes was not extensive, although perhaps 24 percent is more than would be anticipated. Twenty-three percent of the hunters said that they hunted on lands owned by them in their State. Leasing of hunting and fishing rights by individuals was negligible. The ownership of camps for the primary purpose of hunting (15 percent) and fishing (8 percent) varied greatly among the States.

Just how much change has occurred over the years in this pattern of owning a resource base on which to participate is not known. The more rural the hunter and fisherman population, probably the greater the likelihood of resource ownership and thus the easier its accessibility.

It is evident from these statistics that private and public land ownerships are heavily relied upon as a base for participation. For the region, dependency on either type of ownership appears to be equally shared. However, there is often some question whether the sportsman knows who the landowner is. Taking into account the fact that the Northeastern States are predominantly in private ownership would place an inordinate pressure on the existing public land base for hunting. This implies the need for additional public land or public subsidization for management of private lands to promote game availability.

A further implication is the need to maintain or improve access to private lands. Strangely enough, however, at the time of this study, access did not seem to be a problem, because in the region only 17 percent of the hunters and 11 percent of the fishermen indicated it as a problem. The most urban states had the most hunting accessibility problems—New York (23 percent), Massachusetts (21 percent), and Pennsylvania (19 percent). This may indicate that with urbanization come greater access problems and an increased need to provide for public sponsorship of the resource base.

The availability of the resource base for participating in hunting and fishing activity, as well as other outdoor recreation, will be an increasingly perplexing problem. Programs are underway in many states to improve access. As an example, in Maine and Massachusetts, boat-launching facilities have been constructed in recent years. Also, Massachusetts has an active program of land acquisition for game and fish management areas. The free use of the resource base has been the accepted norm in the United States throughout its history. Excluding recreationists from private lands is becoming more common. The reason for posting land may be to control use rather than to preclude it. However, even the hunter and fisherman, who are the ones

excluded, supported the right of private landowners to prohibit these activities on their lands—88 percent of the hunters and 72 percent of the fishermen. The rights of private land ownership are apparently well entrenched and respected by these sportsmen.

Hunting and fishing as a marketable activity is accepted by a fairly substantial number of hunters (43 percent) and fishermen (38 percent), but not by the majority. The price that people are willing to pay for a day of activity is not large. Only 5 percent indicated a willingness to pay over $5 per day for hunting small game and fishing and 20 percent over $5 per day for hunting big game.

The six States in which the regional study was conducted produced some unexpected contrasting findings about willingness to pay to hunt and fish. The two most rural States, Maine and West Virginia, were at the extreme ends of the spectrum. In Maine, 33 percent of the hunters were willing to pay to hunt, while in West Virginia 59 percent were. Thirty-three percent of Maine fishermen indicated a willingness to pay, in West Virginia 50 percent.

The reason for the differences in willingness to pay between hunters and fishermen in these States appears to be due to availability of the resource base. Even though land is plentiful in West Virginia, its use is more restricted. Also, the availability and quality of bodies of water for fishing in Maine are far greater than in West Virginia. In Maine, water bodies larger than 10 acres come under the Great Ponds Act, which requires that they be accessible to public use. Control of the resource base seems to be a major factor in willingness to pay for sport hunting and fishing.

An ever greater opportunity presents itself to market hunting and fishing; and in some States, sale of these rights is already common. The day may come when hunting and fishing on private lands will be available only at a price. Whether the participant or the general public pays is a policy question.

Fish and Game Harvested

We are not going to elaborate too much on the species of game and fish taken for two reasons. One, there is obviously a high correlation between game and fish sought after and their indigenous availability. Second, we begin to tread on even unsteadier ground than heretofore, because of the biological aspects of game management.

If one examines the regional and state statistics, the correlation between species availability and what is hunted or fished is apparent. Deer, small game mammals, and upland game birds (excluding turkey) are hunted most, in that order. Massachusetts and West Virginia are the only States where deer is not uppermost in importance. The deer is replaced by upland game birds in Massachusetts and by small game in West Virginia. In Maine, upland game birds rank second in importance.

In popularity, the fishes in the six States rank this way: trout, bass, panfish, pickerel, and pike. In Maine, salmon ranks second; and in West Virginia bass outranks trout. The ranking by states varies greatly.

Are these really preferences? Biological constraints act to inhibit changing species composition in most states; therefore, what is indigenous is preferred. Some steps can and are being made toward introducing other species, but both the economic and ecological impacts are being more frequently questioned.

One thing that resource managers might do is to change preferences of the consumers—hunters and fishermen. By making available more native species, participation in the activity might be enhanced. The bag or catch may not be the sole reason for participation. To change species preferences, people manipulation is necessary, as opposed to managing fish or game. A little of the Madison Avenue advertising strategy could be helpful. The commercial fisheries industry is attempting to change consumer preferences by convincing people that pollock is as good as haddock. This is an attempt to alter demand to place it in balance with supply.

An entirely new facet in managing and policy-making may be attributed to those recreationists who seek game only for observation purposes. Their objectives are different from those of the hunter, so they create an entirely new set of factors to be considered.

MOTIVATIONS

Motivation and attitude research for this group of recreationists—and in fact for all forms of activities—is in its infancy. Our association with this work has been minimal. The study about hunters by Thomas A. More *(1970)*, as yet unpublished, was done at Massachusetts under Bond's direction. Boat-using sport fishermen were studied in Rhode Island by Irving A. Spaulding *(1970)*. Each of these researchers used a different approach, and their findings are limited in scope but serve to illustrate a point.

In both of these studies an attempt was made to discover why people participated in these activities and what they derived from them. In both, it is our interpretation that the enjoyment of participating was not so much the success of the harvest but the many experiences related to the activity.

Using factor analysis, More was able to isolate seven factors illustrating attitude motivations of hunters. He did this by submitting 52 statements, attitude objects, to a randomly selected sample of licensed Massachusetts hunters. The attitude objects were ranked by respondents on a five-step scale from strongly agree to strongly disagree. A measure of consistency of response within the seven factor groups, termed an *Eiginvalue*, was used to measure the factor strength. The seven factors in order of declining Eiginvalue are: display, aesthetics, communality, pioneering, the kill, familiarity, and challenge. Although the Eiginvalue may be a poor measure for ranking importance, it can serve as an indicator.

What his findings seem to indicate is the importance of the things associated with hunting. Showing off guns, the enjoyment, beauty, and tranquility of being in forest and field, the communality of associates, the escape from everyday responsibilities, the proof of manliness, the challenge of locating the game—all of these things seem to be an integral part of the actual experience of hunting. The display of game and the enjoyment of eating it is also important.

Dr. Spaulding, a sociologist at the University of Rhode Island, has a complex analysis of information collected from 151 mail-questionnaire respondents who were boat-using fishermen. In his conclusions he lists six attributes that sport fishermen would miss if they had to stop fishing: (1) Experiencing the euphoria-tension dynamic, (2) catching fish, (3) involvement with some aspect of the environment, (4) interpersonal relationships and aesthetic attributes of the environment, (5) experiencing transition from one situation to another, and (6) personal integrative responses.

The point to be illustrated by very briefly citing these two motivational studies is that there is obviously more to participation than killing game and catching fish. There is a need for the resource manager and policy-maker to consider these things in their decisions. The interpretation of the findings as they bear upon decisions is not conclusive, but there is obviously some important input information to be gained from this type of social-psychology research.

FUTURE RESEARCH

We have considered two forms of hunter-fisherman research. One concerns the characteristics of present participants; the other an attempt to look within the person to uncover the whys and satisfactions derived from hunting and fishing. An attempt has been made to show how both forms have utility to the manager and policy-maker who is called upon to provide the basics to participation—resource base (environment) and commodity (fish and game).

Future research can be greatly enhanced by the decision-maker telling the researcher what it is that he feels needs to be known about hunters and fishermen. The N.E.M. 35 Regional Committee, in its planning, contacted State fish and game agencies and asked for assistance. Some was provided, but probably not enough.

A follow-up question to accomplished research should be: do managers and policy-makers find it useful? There are two worthwhile reasons for doing this research: it provides a norm for later studies, and it should have current usefulness to those having responsibility for resource management and policy-making.

Future research should be valuable in providing inputs into the decision-making process. We need to build some models and collect data that will help this process. We need to know, first, what is needed, rather than simply going out and collecting a lot of information.

Research in studying people is even more complex than controlled experiments. A marketable and consumable commodity lends itself more readily to an examination of demand than a free-use participatory commodity.

In-depth research into the motivations and attitudes of hunters and fishermen is needed for a better understanding of the values they place on participation. The surface is just being scratched in this research field. It is imperative that the resource specialist contribute his knowledge to the social scientists doing this research. Better still, professional resource personnel who are so inclined can become social scientists and, having backgrounds in both fields, can contribute to a greater degree than those researchers having knowledge of a single discipline.

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THE SKIER: HIS CHARACTERISTICS AND PREFERENCES

by WILLIAM A. LEUSCHNER *and* ROSCOE B. HERRINGTON, *USDA Forest Service, respectively Economist, North Central Forest Experiment Station, St. Paul, Minn.; and Recreation Resource Analyst, Intermountain Forest and Range Experiment Station, Ogden, Utah.*

ABSTRACT. Skiers are young and becoming younger, with increasing proportions of unmarried and female skiers. Many are students and roughly half of the remainder earn their livings as professionals (doctor, lawyer, teacher). Skiers have higher-than-average incomes. Most skiers never go away overnight to ski and seldom travel great distances. Forty percent of the skiers have skied 3 years or less. Day skiers ranked proximity as the most important reason for skiing at a particular area. The physical quality of ski slopes (not including snow quality) was ranked second by the day skier and first by skiers planning weekend and vacation trips.

SKIERS ARE such a small part of the total population—not more than 2 percent—that it is difficult to collect a sound sample. Consequently, few publications contain original data about skiers, particularly skiers distributed over a large geographical area. In this paper we will draw primarily upon the only three sources of regional skier data: Sno-Engineering *(1965)* for the Northeastern States in the 1962-63 and 1963-64 seasons; Herrington *(1967)* for the Western States in the 1964-65 season; and Leuschner *(1970)* for the Midwestern States in the 1968-69 season.

Surveys by *Ski* magazine in the 1964-65 and 1967-68 seasons were reported by Pitts *(1968)*. But as Pitts pointed out, these were surveys of subscribers, so they probably were not entirely representative of the average skier in the United States. For example, one would expect a higher percent of high income and student skiers because of the subscription cost and reduced student subscription rates. However, wherever possible we used Pitts' data because they are original.

The comparison of data from surveys made in different regions in different years causes a problem because differences among the surveys may be due to interregional differences, or may be due to year-to-year changes in skiers—skier population trends. Even more disconcerting in making comparisons is the unknown influence of differences due to sampling procedures and analyses. We tried to isolate interregional differences and population trends by inference and by substantiating evidence wherever possible, but the reader should remember that many statements depend heavily on the authors' judgment.

SKIER CHARACTERISTICS

Most skiers are young. About two-thirds of those studied are 30 years or less and a fifth to a third 18 years or younger. These

Figure 1. — Age distribution of skiers by region, in percent. (N.R. = no response.)

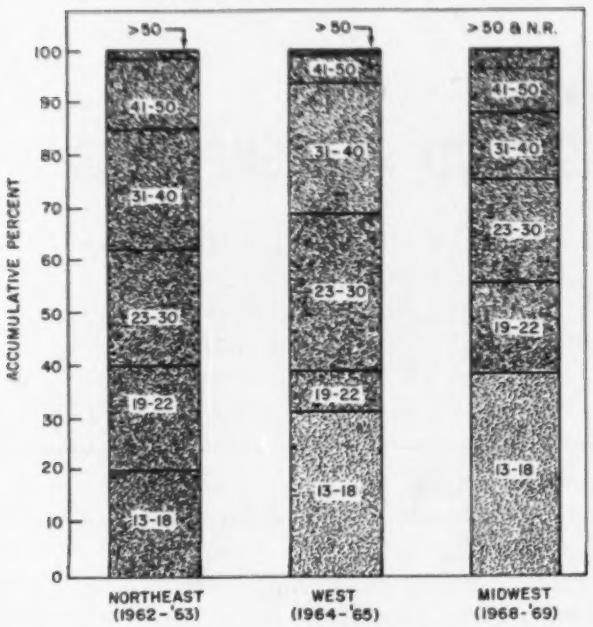


Figure 2.—Years education of skiers, by region, in percent.

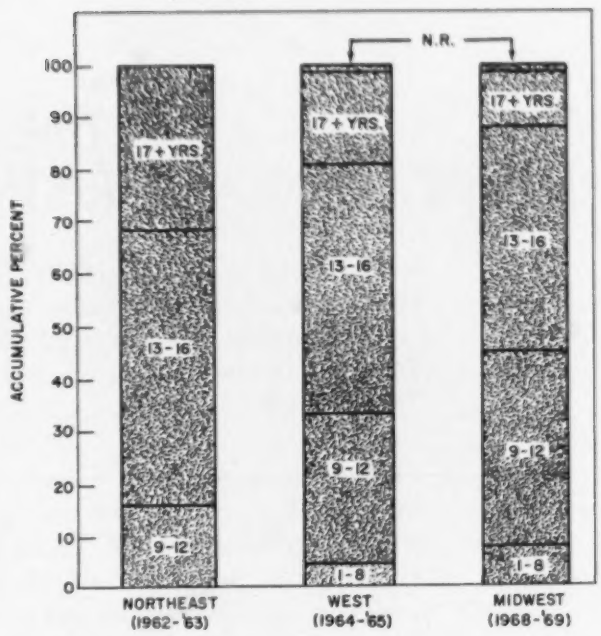
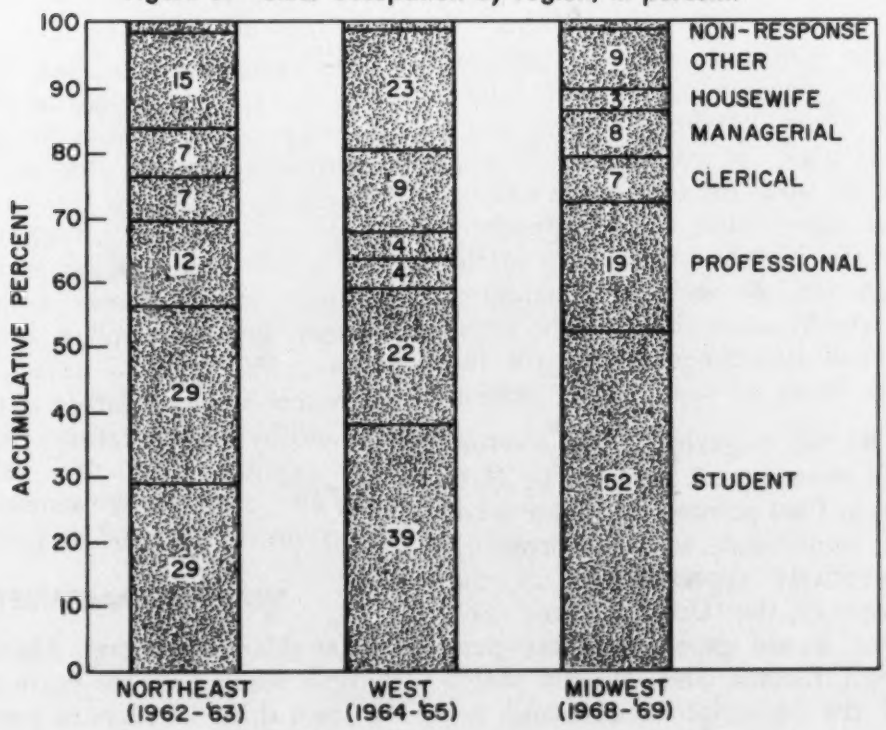


Figure 3.—Skier occupation by region, in percent.



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proportions should be even higher because the studies did not include skiers under 12 or 13 years old. Skiers are either younger in the Midwest than the West and younger in the West than the Northeast, or the population has a trend toward younger skiers (fig. 1). A trend toward younger skiers is consistent with the national trend toward a younger population, the apparent decrease in the education level (fig. 2), and the increase in the percentage of students (fig. 3). A population trend toward younger skiers was also noted by Pitts *(1968)*.

The indications that skiers are young and becoming still younger are supported by our general observations of the sport. Skiing is an active sport; it requires greater endurance and stamina than many other popular forms of outdoor recreation, and it is potentially hazardous. All these characteristics usually appeal more to teenagers and young adults than to older persons.

The proportion of unmarried skiers increased from about a third in 1964-65 in the West to about two-thirds in 1968-69 in the Midwest (table 1). Pitts *(1968)* also mentioned a shift toward unmarried skiers. The proportion of unmarried skiers in the Northeast may be due to young unmarried people being attracted to the large population centers for social and occupational reasons.

In all three studies the skier was found to be more affluent than the median in his region of the United States; in most cases his income was 25 to 30 percent higher.

There was an increase in the proportion of female skiers between the Western and Midwestern estimates. The oldest study reported 38 percent females in the Northeast, which contradicts a trend toward more females. But Pitts *(1968)* in the newest study, notes an increase of about 5 percent. On balance, there seems to be a trend toward more female skiers.

The following general characteristics emerge. Skiers are young, and on the average becoming younger. Most are unmarried. There may be a trend toward a greater proportion of females. A large percentage of skiers are students—over half in the Midwest. Skiers have higher incomes than the average citizen, and, except for students, roughly half earn their livings in professions (doctor, lawyer, teacher), implying a higher-than-average educational level.

Past use patterns may help us predict how skiers will act in the future. In both the Western and Midwestern studies it was estimated that about 1 percent of the regional population skied, the percentages in individual states ranging from 0.1 to 3.1 percent. Thus the number of skiers in the United States is not likely to exceed 1 or 2 percent of the national population. Both of these studies showed that attendance grew nearly 20 percent per year during the last decade, but projections indicate a diminishing rate of growth.

Both studies showed that residents of the study-area states accounted for about 85 percent of the days skied in the study area. Although nonresident skiers do not account for a significant proportion of the total skiing for either region, they are a significant influence in some states, such as Colorado.

One question is: what kind of skiing trips were taken? Between 80 and 90 percent of all skiers took either single-day trips, weekend trips, or a combination of the two (table 2). In other words, most

Table 1.—*Percent of skiers by region, sex, and marital status*

Region (season)	Married			Unmarried		
	Male	Female	Total	Male	Female	Total
Northeast (1962-63)	—	—	40.3	—	—	59.6
West (1964-65)	47.0	15.0	62.0	25.0	13.0	38.0
Midwest (1968-69)	21.4	14.3	35.7	32.1	31.1	63.2

Table 2.—*Percentage of skiers taking various combinations of trips, Midwest and West*

Year (region)	Day only	Weekend only	Day and weekend	Other	No response
1968-69 (Midwest)	58	15	17	7	3
1964-65 (West)	46	13	23	18	0

skiers never go away overnight to ski, and those who do seldom go for more than 3 nights.

A single-day trip is defined as one in which the skier travels to the ski area and returns home the same day. A weekend trip is one in which the skier is away from home at least 1 night but less than 4 nights, for the primary purpose of skiing. A vacation trip is one in which the skier is away from home 4 or more nights for the primary purpose of skiing.

Skiers generally are not willing to—or do not have to—travel great distances to do their skiing (fig. 4). The Midwestern skier travels farther than his Western counterpart. This may be due to improved highways in the years between the studies; location of ski areas in relation to population centers; or, in the case of vacation trips, to the Midwesterner traveling East or West to ski.

At the time of the surveys about 40 percent of the skiers had been skiing 3 years or less, and almost three-fourths had been skiing 8 years or less (fig. 5). Moreover, these figures are amazingly consistent over all the surveys.

There is a large difference between regions in the number of days skied per skier, the Northeast reporting an average of 17.7, the West 10.3, and the Midwest 5.7. There is little additional evidence indicating whether this is an interregional difference

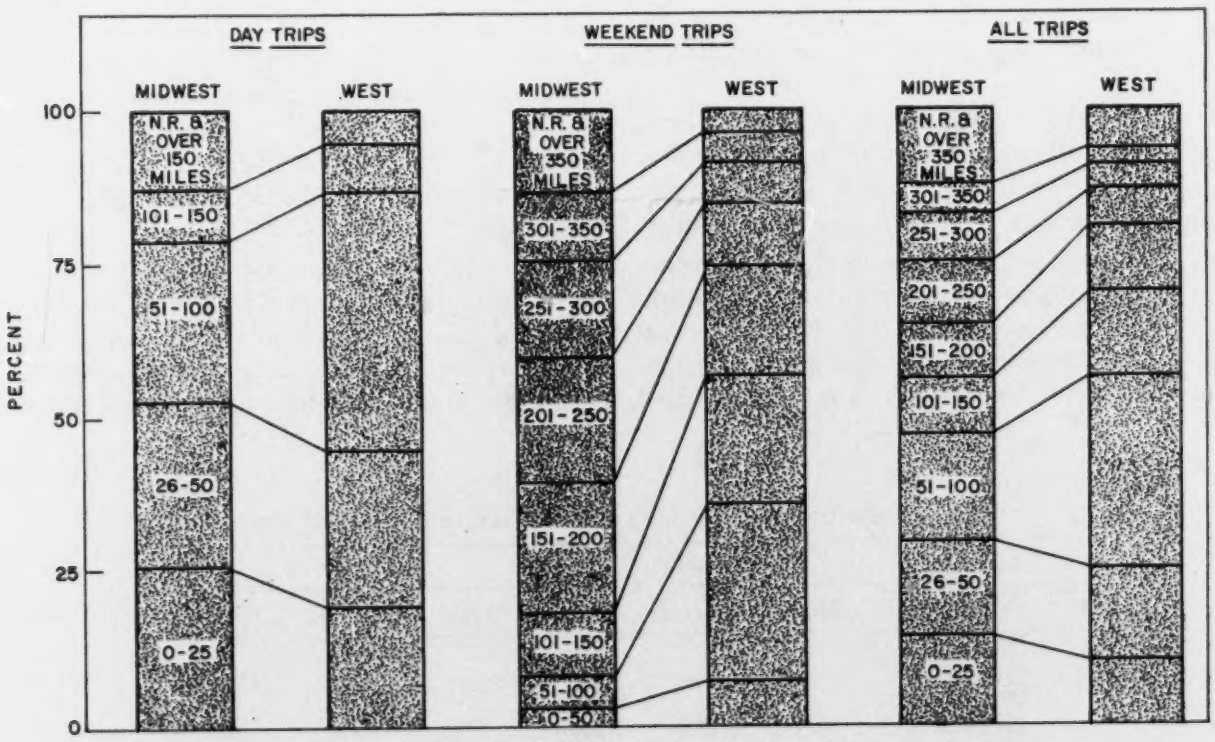

Figure 4.—Percentage of resident skiers traveling by auto, by one-way distance, class, and type of trip.

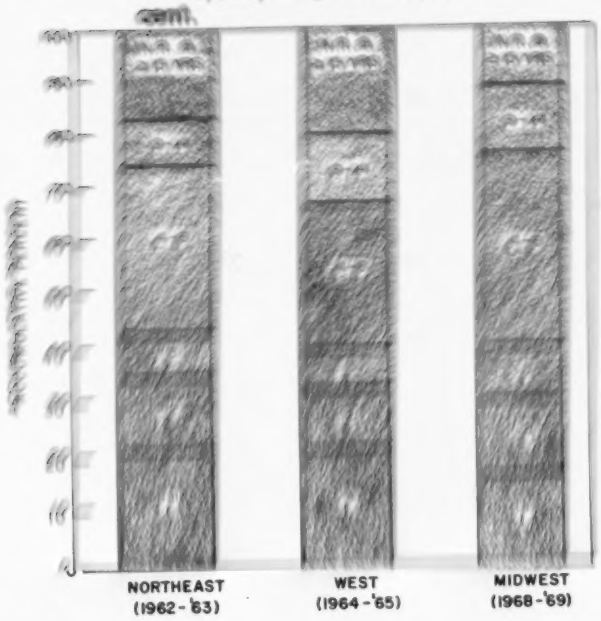

Figure 5.—Number of years skied at time of survey, by region, in percent.

or a population trend. We suspect, but cannot prove, that the 17.7 days per skier reported for the Northeast may be the result of the weighting system used in analyzing the sample.

SKIER PREFERENCES

In the Midwestern study, skiers were asked why they skied at one area instead of another. The day-skiers ranked proximity as the most important reason for skiing at a particular area. The physical quality of the ski slopes (not including snow quality) was ranked second by the day-skier and first by skiers planning weekend or vacation trips (tables 3 and 4).

Cable lift facilities were considered desirable but clearly less important. The day-skier next considered low ticket prices and the area's reputation among other skiers. The weekend-vacation skier considered the area's reputation, the expected amount of crowding, and after-ski entertainment.

Operators of ski areas were asked what factors limited attendance at their areas. Weather variables were ranked first by operators as limiting attendance. Inadequate tow and lift capacity and not enough skiable area, both of which relate to crowdedness, were ranked next. Inadequate service facilities and overnight accommodations were ranked fourth and fifth, followed by skier preference for cable versus rope lift facilities. Operators ranked crowdedness variables higher than skiers did, and cable facilities lower.

The reader should use caution in interpreting these results. For example, the low price of tow and lift tickets may not attract a skier, but a high price may drive him away. Also, advertising may not convince a skier to attend a particular ski area, but it may be important to inform him of the days and hours the area is open or of events of special interest, such as discount evening ski schools. Finally, these results do not show why the skier goes skiing on a particular day, but why he goes to a particular ski area.

Although the Northeastern and Western studies did not include questions about motives, the Western study contained comparable expenditure data, which may indicate skier interests (table 5). The consistency in the percentage distributions of skier expenditures between the Western and Midwestern studies is also noteworthy.

Expenditures for lift tickets constitute about a quarter of the average daily expenditure for all skiers and about one-third of that for the day-skiers. Skiers are apparently willing to pay for the quality of the slopes and the tow and lift facilities they use, both in the West and the Midwest. The moderate expenditure on after-skiing entertainment also seems to support the moderate ranking that skiers gave it on the motives question. On the other hand, on-site eating, drinking, and lodging places were ranked low, but accounted for a high percentage of expenditure. This may be due to the monopoly position of a ski area selling food to skiers or may reflect the importance of off-site eating, drinking, and lodging facilities.

These findings may be substantiated by those of Echelberger and Shafer *(1970)*, who used factor analysis to examine the relationship between several variables and annual attendance at 26 ski resorts in northern New England and New York State. They found that, in a bad snow year, attendance was positively related to the ad-

Table 3.—Motives for choosing ski areas for single-day trips, in the Midwest, 1968-69 season
[In percent]

Motive	Importance of motive					
	First	Second	Third	Fourth	Fifth	Sum of 1-3
Closeness to residence	9.7	15.9	10.4	6.5	9.6	72.0
Physical quality of slopes	29.9	20.5	14.1	7.8	8.1	60.5
Presence of cable facilities	5.9	17.2	16.1	14.1	6.5	39.2
Low price of tow and lift tickets	2.5	15.8	19.2	7.9	7.2	34.5
Expert reputation with skiers	6.6	7.9	9.6	7.4	9.9	23.9
Expected amount of crowding	2.5	7.9	14.7	9.1	8.4	25.1
Reputation for after-ski entertainment	5.4	9.8	9.3	9.6	9.4	24.5
Other	4.5	3.1	3.3	4.5	4.5	10.9
Advertising	1.1	1.9	3.8	6.7	6.7	6.8
On-site eating, drinking, and/or lodging facilities	.4	2.6	3.8	9.7	7.3	6.9
Number of other ski areas in vicinity	1.8	2.7	3.7	5.4	7.9	8.3
No motive mentioned	—	1.8	10.0	14.0	10.4	11.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.—*Motives for choosing ski areas for weekend or vacation trips, in the Midwest, 1968-69 season*
[In percent]

Motive	Importance of motive					
	First	Second	Third	Fourth	Fifth	Sum of 1-3
Physical quality of slopes	54.5	17.0	6.5	6.9	3.2	78.0
Presence of cable facilities	4.4	19.2	19.6	9.9	6.2	43.2
Area's reputation with skiers	13.9	9.4	7.4	9.7	5.8	30.7
Expected amount of crowding	1.8	10.8	16.6	11.5	7.9	29.2
Reputation for after-ski entertainment	5.6	12.2	8.3	4.8	8.2	26.1
On-site eating, drinking, and/or lodging facilities	2.0	9.5	9.3	8.2	8.1	20.8
Advertising	5.5	4.2	5.8	4.8	4.2	15.5
Closeness to residence	5.3	4.9	5.2	6.7	5.8	15.4
Low price of tow and lift tickets	1.8	3.2	9.1	6.1	8.8	14.1
Number of other ski areas in vicinity	.9	5.2	4.1	4.9	5.0	10.2
Other	4.3	1.8	1.7	1.0	.9	7.8
No motive mentioned	—	2.6	6.4	25.5	35.9	9.0
Total	100.0	100.0	100.0	100.0	100.0	300.0

Table 5.—*Skier expenditure by region, type of trip, and item*
[In percent]

Item	Average for all trips		Single-day trip		Weekend trip	
	Midwest (1968-69)	West (1964-65)	Midwest (1968-69)	West (1964-65)	Midwest (1968-69)	West (1964-65)
Lodging and meals	28.3	27.9	17.6	13.4	38.0	33.7
Lift tickets	24.1	23.8	34.9	35.9	16.6	20.5
After-ski entertainment	8.5	11.0	8.0	7.4	9.7	14.0
Transportation	16.5	18.7	15.8	22.5	15.5	15.9
Other[1]	22.6	18.6	23.7	20.8	20.2	16.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

[1]Includes equipment rental and repairs, lessons, package plans, and other miscellaneous items.

vertising budget. In a good snow year, attendance was positively related to miles of intermediate trail (possibly a quality factor), was negatively related to travel time, and was also related to some compound variables including those two already mentioned plus percent of slopes rolled and packed and the number of ski instructors. Data averaged for the 2 years showed positive relationships with advertising and a positive relationship with distance, which leveled off as distance increased.

IMPLICATIONS FOR MANAGERS

Whether new ski areas should be built or existing ones should be expanded is a complex question, beyond the scope of this paper. We assumed that the ski-area or recreation manager wished to provide as much skiing pleasure to as many skiers as possible and did not consider questions of net welfare maximization or cost. The findings of these studies pose several implications for managers.

- In all likelihood the total skier population will grow as the population grows during the next few years, and attendance may double in the next 5 to 10 years. This may indicate a substantial future demand, particularly at lower cost public areas.
- The large population of skiers with only a few years experience, combined with skier dropouts, indicates that a substantial part of the skier population will continue to have only a moderate degree of expertise. This implies that many slopes should be in the beginner and intermediate categories and that good ski schools are needed. Further, if attendance reaches projected levels, the number of novice skiers should increase. There is probably an opportunity for some ski areas near large population centers to specialize in providing ski slopes and instruction for the beginning skier.
- Stated skier preference, average distances traveled, and the large proportion of single-day ski trips all indicate the importance of locating a ski area near population centers. The trend toward a younger skier population, if continued, may further decrease the distances traveled and increase the proportion of single-day trips. The development of snowmaking equipment makes rural location for snow much less important.
- Slopes and trails should be varied, interesting, and challenging within their respective difficulty classes to meet skier preferences for high-quality ski slopes.
- If there is a trend toward fewer days skied per season (as if a ski area is in a lower use region) it may be appropriate to investigate ways of increasing annual use per skier. This will more fully utilize fixed-cost items (to the extent overcapacity exists) and could help the private sector increase profitability.
- The large proportion of day and weekend trips implies that managers of new or existing ski areas should re-examine plans and programs depending on vacation trips because the vacation market is relatively very small. The area managers may decide to either emphasize or deemphasize vacation skier programs. (This statement applies only to the proportion of vacation trips. It may be that increasing numbers of skiers will offset a low or decreasing proportion of vacation trips.)

These are merely some of the implications, and they are directed primarily toward publicly owned areas. The concerned and imaginative manager will think of others. For example, the decreasing age of skiers should decrease the relative importance of after-ski activities. Research can discover and interpret information, but the administrator must apply it to his own unique situation.

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THE SNOWMOBILE

by JOHN W. HETHERINGTON, *Vice President for Marketing, Ski-Doo Division, Bombardier, Ltd., Montreal, Quebec, Canada.*

ABSTRACT. As use of the snowmobile has increased—nearly 1½ million now in use—the development and maintenance of snowmobile use areas has become a concern. A study made by Bombardier, Ltd., calls attention to safety problems, costs, trail design and maintenance, sign systems, rules and aids for snowmobilers, safety patrols and other services, and safeguards for the environment.

THE NUMBER of people who spend their time in the out-of-doors increases dramatically each year. It has been estimated that the American public will enjoy some 186 million recreation-days in 1971. Unfortunately, as the number of people who are turning to the out-of-doors increases—in 1970 nearly 400 million people spent their leisure time automobiling, camping, hunting, boating, and snowmobiling—the amount of natural resources remains the same; but with careful planning, more recreational areas can be developed, making our natural resources more productive.

It is up to people in the recreation industry to assist in developing methods whereby these millions of people can make the most efficient use of the available land. Governments at all levels will have to continue to invest in more recreational facilities. But they need to have all the necessary information to get the most for the dollars that they invest. And the problem must definitely be approached with an eye toward the protection of the environment. In this way, the concerns of all people, outdoorsmen, environmentalists, conservationists, sportsmen, will be taken into consideration.

Up until last winter there was little factual information about the development and maintenance of snowmobile use areas. In an effort to develop this information, Bombardier Limited undertook an extensive survey of snowmobile use areas.

THE BOMBARDIER STUDY

During the winter of 1971, Bombardier conducted a qualitative sampling of approximately 50 snowmobile use areas throughout the North American snowbelt. To achieve a representative geographic sample, the leading snowmobile manufacturer asked each of its 14 distributors to submit 5 to 10 use areas in his particular territory. Snowmobile associations and park organizations also were consulted.

Previously, Bombardier had conducted a mail survey to gather information about snowmobile rental operations. The returns were so few and the data so sketchy that no accurate conclusions could be made. Use area operators were generally an unsophisticated group of people who kept no records and had little detailed information about snowmobile facilities. However, it was discovered that there was a great demand for facts on snowmobile trail areas

and rental operations, as the few people who did respond to the initial Bombardier survey all asked to be sent the findings when they were produced.

It became evident that some organization would have to go into the field and gather the information firsthand. To do the research, Bombardier selected three outdoor writers who had extensive snowmobile experience.

All were qualified photographers, which proved extremely beneficial because, once again, detailed information was difficult to obtain. Their photographic records contributed greatly to the study. They used a specially designed two-page form to obtain specific information. From 15 January to 15 April, they conducted interviews with the people involved in developing and maintaining each area.

Because many areas are really not a specific place of business, the researchers had to seek out and talk to snowmobile club members and officers, park and recreational area personnel, resort owners, and snowmobile dealers. To gage the economic impact of snowmobiling in these areas, the team of researchers also spoke with restaurant and motel owners, service station operators, and chamber of commerce people, and confirmed the fact that snowmobile use centers are a definite financial boon to any community.

To achieve a true cross-section, the researchers visited areas in all sections of the United States and Canadian snowbelts. Although many aspects of trail development are universal, they found that each region has its own unique problems and requirements. The wide open spaces of the western United States contrast greatly with the heavily wooded areas of Michigan, Quebec, or New York.

Not only was the study structured to include samples from a broad geographic base, but every conceivable type of use area also was sought out. Included were visits to nine state and six national forest land use areas, as well as five areas developed by cities or townships. Fourteen trail networks visited were developed by snowmobile clubs; 11 were privately run enterprises. Two areas of corporation-owned land open to the public were surveyed, as were three golf courses. Some systems ran rental operations in conjunction with the trails. As on ski areas, some trails were for expert snowmobilers, some for beginners.

SAFETY PROBLEM

Bombardier undertook this project for three reasons. First, snowmobiling in a well-maintained and controlled use area can eliminate many of the safety problems that confront the industry today. Bombardier has been studying the safety problem for the past 4 years in cooperation with the National and Canada Safety Councils. Investigations show that a majority of snowmobile-related fatalities occur on roads and highways. Snowmobiles are designed as off-road vehicles, and should not be operated on the road. In most states and provinces it is against the law to use them on roads.

Nevertheless, people are driving their sleds on roadways and are dying because of it.

Why do people disregard the facts and continue to operate snowmobiles in dangerous situations? It is largely because there are not enough suitably designed use areas available for the snowmobiling public.

Safety problems arise from irresponsible operation in the wrong locale and are not inherent in the machines themselves. Many of the accidents, injuries, and fatalities can be eliminated through the development of well-designed trail facilities, which would put machine operators in a controlled use situation and thus would foster safe enjoyment of this family sport.

ENVIRONMENTAL PROBLEM

The second reason for this study is that snowmobiling has been severely criticized recently by some environmentalists. Part of this criticism is justified, some is not; and much of it lies somewhere in the middle—in other words, no documented conclusions can be drawn because the problem has never been thoroughly and objectively researched.

Environmental problems that do exist can be controlled by developing trail areas designed with environmental safeguards in mind. Trails can and should be routed so that the noise of the machines will not bother local residents. They should be constructed away from areas where wildlife winters and where plant life might be affected. Use areas should be developed so that they blend in naturally with the terrain.

Finally, Bombardier undertook this study because snowmobiling has mushroomed into unbelievable proportions in slightly more than a decade. Last year the industry produced 563,000 snowmobiles, and about 500,000 were sold at retail. The number of machines now in use is 1,400,000 and should exceed 2 million by the end of next year. In many areas of North America where machine registration is high, snowmobilers are finding that the space where they can enjoy their sport seems to become more limited each year.

What are the specifics of use-area development? Let's take a look at what the study uncovered and what Bombardier recommends should be included in acceptable use areas.

The first concern to any use area, of course, is financing. How much will it cost to develop snowmobile trails? In most cases studied, the development of the trail system itself was very inexpensive. A majority of successful trail systems utilize some type of trails already in existence, such as old logging roads, unplowed or unused highways, abandoned railroad rights-of-way, bridle paths, or hiking trails. Over 80 percent of the use areas sampled rely heavily upon old logging roads, which created a good natural trail system that took on a spider-web effect.

If already existing trails or roads of one type or another are used without the construction of any new trails, development costs will be minimal. Almost every trail system built on already existing trails does not even list a development cost figure in its books. In most cases volunteer workers, using chain saws, etc. to clear brush and stumps from the trail, needed only 2 or 3 days to prepare an area.

COST FACTORS

The Bombardier study showed that the other cost factors to consider in the development of the trails involve the building of bridges over land or water hazards, the clearing of new or connecting trails, and the erection of barriers around dangerous or sensitive areas. Labor costs for clearing the trails and preparing them for snowmobiling, and the cost of clearing equipment, were provided on a volunteer basis in the majority of instances. In much of the snowbelt there still remain thousands of miles of trails that with a little effort can be made ideal for snowmobile use. Some funds will have to be spent on building access trails and linking together available use areas. In the future we must be ready to make the necessary investment in the heavy equipment that will be required to develop trails from scratch.

Remember that at this point we are not talking about maintenance, signing, restaurants, or any associated facilities.

From the areas that did keep an accurate record of the cost of trail development, it has been determined that the cost ranges between $100 and $150 for each mile of trail constructed, depending on the type of terrain, equipment, and amount of manpower required.

The report covers a few new trail systems that were developed with the help of landscape architects, environmental experts, and park supervisors. These individuals were able to design interesting trail systems by using topographical and aerial maps. These people also can give advice when already existing trails need to be altered to make them acceptable for snowmobile use because of safety or environmental considerations. Most of these people, especially if they were snowmobilers themselves, volunteered their time.

These then are the types of trails found available:

A system on public land financed by snowmobile registration fees – some enlightened governments have taken definite steps to develop the public land under their jurisdiction.

A system on private or public lands informally developed by snowmobile clubs.

Networks on the property of large corporations such as paper companies or land developers.

Regulated areas set up by local businessmen on private land with use fees or rental machines.

A system on private land for the use of patrons of a lodge, hotel, or resort.

These last two types are the most tightly controlled of all use areas.

Through the survey it was found that a minimum depth of 3 inches of snow is recommended for snowmobile operation. Good trail systems are designed with definite destinations or routes in mind, showing points of scenic or historical interest. The topography was varied to keep the rider interested and on the trail. The most popular trails connect towns, scenic lookouts, or restaurants and give a purpose to snowmobile trips.

TRAIL DESIGN

To get the maximum return from available land, trails should be designed for multiple use such as snowmobiling in the winter and trailbiking, horseback riding, and hiking in the summer. Trails should not conflict with other winter sports like cross-country skiing or snowshoeing. Not only is this unsafe; it also infringes on the rights of others. Bombardier also advocates the concept of sensible zoning of areas where no vehicular traffic is permitted. These wilderness areas should be respected by all those concerned.

The study indicates that trails should be at least 10 feet wide and run in only one direction. Bombardier found that even some very wide trails had dangerous spots at sharp curves if they ran in both directions. To eliminate possible head-on collisions, one-way trails should be the rule. On some extremely wide trails, the construction of a median in the center was found to be an effective means of dividing a trail.

Width of trails may have to vary because of the terrain, but situations where a snowmobile must attempt to squeeze between two trees or other fixed objects should be avoided. Also, if trails are 10 feet wide, trail maintenance will become easier because efficient maintenance vehicles are at least 7 feet wide.

Though the trail systems visited varied in length from 4 miles to 500 miles, the average and suggested trail length is 50 miles. The most popular system is the spider web, which in most cases fits perfectly into the pattern of old logging roads that were utilized for the trails. Small looped trails within a larger system provide suitable length for all types of riders. For instance, in a system where the longest trail is 50 miles, shorter trails of 1, 5, 10, and 25 miles within the longest trail are ideal. The important thing is to make certain that a snowmobiler can easily return to his starting point. The best areas have a sign-in, sign-out system set up at the start of all trails in order to keep track of how many people are out on the trail.

Some areas also identify trails according to their difficulty, specifying certain trails for beginners and others for intermediates or experts.

SIGN SYSTEM

The Bombardier study also deals with the problem of adequate trail signs. Although a uniform sign system has been developed, almost every trail area visited has designed its own signing system. Bombardier encourages the utilization of the standardized, international signing system developed by the International Snowmobile Congress and the United States Bureau of Outdoor Recreation.

Signs should be posted in such a manner that they do not detract from the natural beauty of an area. At the same time, however, directional arrows and reassurance markers should be used in quantities adequate enough to do the job. Most areas occasionally used helpful mileage signs, as well as signs noting various points of interest along the trail. The safest systems have stop signs posted at trail intersections and public highways.

Markers should be erected to denote hazardous or sensitive areas. Areas that snowmobilers should stay away from can be effectively marked off with bright plastic flags or snow fences.

The Bombardier survey shows that it is very easy to stray off a trail when riding over a stretch of open land, and that finding the place where the trail goes back into the forest can be quite difficult. Make sure trails are identified over long open stretches.

Though to the uninitiated, banked curves may be considered safer than flat curves, area operators interviewed believe that banking curves encourages high speeds, while flat curves will result in a reduction of speed. The study shows that banked curves should be used only to protect snowmobilers from a sudden drop in terrain or a fixed or hidden object. Trails running adjacent to a sudden drop in terrain, such as a deep valley or a cliff, should be avoided, as trails tend to get drifted over and side-hilling on a snowmobile becomes difficult. If rerouting is impractical, the construction of a fence or other barrier between the trail and the drop will minimize this problem.

RULES & AIDS

Snowmobilers should not go out on the trail alone. The study found that the better use areas enforce a "buddy-system" rule. Required check-ins and check-outs are advisable. Both of these rules will cut down the number of lost or stranded snowmobilers.

Safety instructions should be made available to all snowmobilers in the form of booklets. Practical instruction for the beginning snowmobiler is a must, especially in rental operations. Bombardier has distributed nearly 2 million of its safety booklet, "Play Safe," which was produced in cooperation with the National and Canada Safety Councils. "Play Safe" is available free from Ski-Doo dealers, distributors, and both Safety Councils.

The best trail systems have maps posted along trail routes, showing the snowmobiler where he is and where he is going. Maps also should be distributed by regional tourist offices, clubs, and local governments. With 65 percent of all snowmobiles sold in rural areas, the development and distribution of trail maps is essential to the future of this industry. More and more metropolitan dwellers are beginning to enjoy the sport of snowmobiling. Unlike their country cousins, they are not familiar with convenient places to run their machines. Recognizing this fact, many snowmobile distributors and dealers have taken the lead and have produced their own trail and use-area maps.

Twenty-five percent of the use areas contacted in the study have organized trail patrols. The best examples cover every mile of trail in the system at least once a day. Safety patrols should not only service machine breakdowns, help stranded snowmobilers, and give medical aid in emergencies, but also they should serve as the area's police force, stopping, warning, and even expelling snowmobilers who are breaking the area's rules.

Associated facilities that make a trail system more attractive to snowmobilers include adequate parking space for use-area size. This is extremely important. Many areas reported that people were unloading their machines on the side of roads—a definite safety hazard. It does not do much good to have 100 miles of trails that only a handful of people can get to. Space should permit the loading and unloading of snowmobiles from trailers. County governments should be called on to keep roadways and parking areas well plowed. Picnic areas, restroom facilities, warming huts, and litter cans are some basic services that greatly enhance any area.

Lodges and restaurants are found at most privately run resort-oriented areas. In many cases this type of facility is, of course, not feasible. But even a simple snack bar arrangement can be a great service to the snowmobiler while at the same time providing an excellent source of income for the use area. Gas, oil, and repair services also are suggested.

Although not generally the rule, some private areas charge a fee for using the trails, and several also have rental machines. The fee for a snowmobiler with his own machine varied greatly according to the available facilities, but an average was $10 a day. Most private areas operating to make a profit from their trail system offer machines for rental at an average cost of

between $7 and $10 per hour. Special full-day rates also are available. They range from $25 to $40 a day.

TRAIL MAINTENANCE

Most areas have solved the insurance-liability problem by requiring a signed waiver of responsibility from anyone using the trail system or renting a machine. Renters also are responsible for machine damage. Local laws and insurance situations should be investigated by anyone operating a use area.

The biggest problem, found universally throughout the use areas visited in the Bombardier study, is trail maintenance. This is where the largest amounts of time, money, and effort are spent on every use area. Maintenance equipment must be purchased; personnel must be hired. Moguls and bare spots must be groomed regularly if area operators wish to have snowmobilers return.

One problem in trail maintenance has been simply a lack of equipment available to do the job. Crude attempts were made, and people come up with some pretty inventive measures; but most were inefficient and just not acceptable. This past winter, Bombardier began to produce what it hopes will be the solution to the trail-grooming problem—the Skidozer 200. This unit was designed specifically for trail maintenance.

Only the more sophisticated areas or the ones in business for their own financial gain have detailed records of development and maintenance costs. Volunteer man-hours accounted for over 85 percent of all trail maintenance and construction. The survey does reveal that it costs approximately $100 per mile per season to maintain trails. This figure is based on every mile of trail being groomed at least once every other day. The money goes toward operators' salaries, machine depreciation, and maintenance of equipment. Use fees, gas and oil services, and restaurants help offset maintenance costs. Volunteer man-hours and machinery will also lower this cost.

More needs to be done to encourage use-area development throughout the snowbelt. Economically these trails systems are a boon to the communities in which they are located. Virtually every area contacted emphasized a new economic prosperity as an outgrowth of snowmobile activity. But this is not the only consideration.

Trails are needed to insure safety, to safeguard the environment, to protect the rights of non-snowmobilers, and to give those people who enjoy the thrill of an afternoon's ride across a snow-white trail a change to use their machines in a properly constructed and maintained area.

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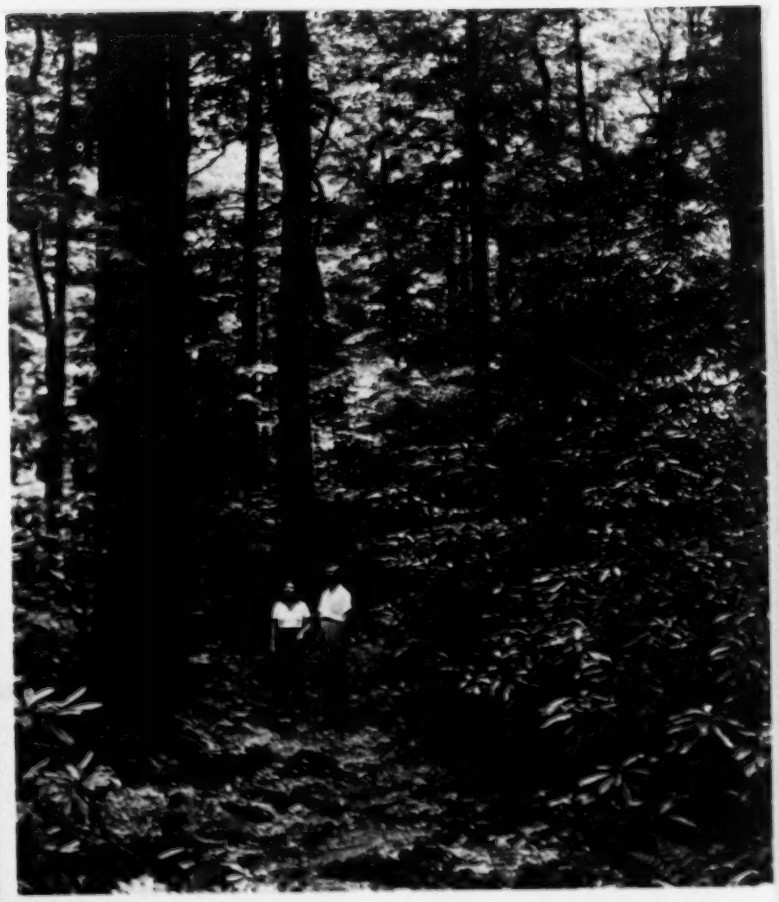
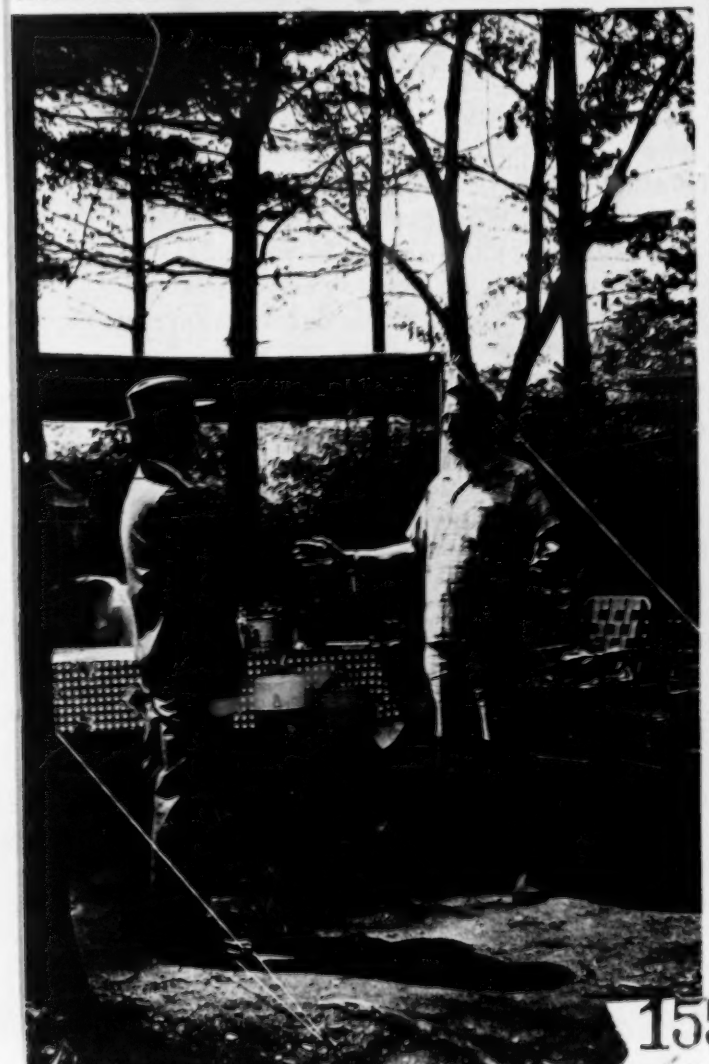
Specific Managerial Considerations Related to User Characteristics





UNDESIRABLE BEHAVIOR IN FOREST CAMPGROUNDS

by ROGER N. CLARK, *Cooperative Research Assistant, University of Washington College of Forest Resources and USDA Forest Service Pacific Northwest Forest and Range Experiment Station, Seattle, Wash.*

ABSTRACT. A 3-year study indicates that nuisance behaviors, law violations, vandalism, and littering in forest campgrounds are more extensive than is generally believed. All campers share responsibility for the problems. Violations occur because of ignorance of, lack of understanding, or a willingness to disregard rules. Control measures are discussed, including an incentive system utilizing monetary and nonmonetary rewards, which was used successfully to control littering in a large forest campground.

VANDALISM, nuisance behavior, littering, and violation of rules and regulations are major recreation management problems. The direct costs of replacing vandalized facilities and restoring areas that have excessively deteriorated from careless and indifferent use are increasing at an alarming rate, while other inappropriate behavior decreases the quality of recreation experiences.

In our studies, we focused on the activities of recreationists and the attitudes of campground officials as related to depreciative behavior. To simplify the studies and to concentrate on the areas where depreciative behaviors are more prevalent, only intensively developed forest campgrounds that attracted large numbers of people were studied.

Data reported here were collected at Lake Kachess campground in the Wenatchee National Forest, although supplementary data were collected in similar campgrounds. The campground is characterized by heavy use, highly developed facilities, opportunity for water-oriented activities, and resident rangers.

THE EXTENT OF DEPRECIATIVE BEHAVIOR

During the summer of 1968, we used systematic participant-observation techniques to record depreciative behavior without disturbing campers or influencing their actions. Our observers mingled unobtrusively with other campers in selected areas and recorded specific information on all depreciative acts observed. The data collected included a description and classification of the act, personal characteristics of the offender, apparent cause or motivation for the act, reaction of those involved and of other campers, official action taken, and apparent results.

Types of Depreciative Behavior

Because we looked harder and more systematically, we saw more problem behavior than the average camper would see. Although we observed many depreciative acts, our attention was drawn to a continual series of major and minor violations carried out by people who were either unthinking

or considered themselves above a particular rule.

Nuisance acts were the most common; they accounted for half of all depreciative behavior reported (50 percent). Legal violations were the next most frequent, accounting for about one-third (37 percent), followed by acts of vandalism (13 percent). Of the nuisance acts observed, almost 80 percent involved pets running loose; the remainder included excessive noise, violations of privacy, sanitary offenses, and hazardous behavior such as throwing rocks in the swimming area.

Most legal violations involved campground rules, followed by traffic violations and littering. Only a handful of civil law violations were observed. Theft was infrequent in number of occurrences, but was expensive.

About 60 percent of the vandalism acts were directed at campground facilities, and only 30 percent involved the natural environment. Public, not private, property was usually the target of vandals in the cases we observed.

Who Was Involved?

One interesting and unexpected finding was that teenagers and children committed depreciative acts in roughly the same proportion as they appeared in the campground, although they differed somewhat in the type of acts committed. According to our observations, teenagers were most likely to violate campground rules, including traffic regulations, and were less likely than adults or children to commit nuisance acts.

Children, usually while playing in groups of two or three, were responsible for most acts of vandalism, which were directed primarily at campground facilities. But the most frequent types of inappropriate behavior for children were nuisance acts most often involving pets and violations of privacy.

Adults committed nuisance acts most frequently and were a close second to teenagers in violations. When adults were observed in vandalistic acts, it usually focused on the natural environment rather than on campground facilities. These adult acts involved individuals rather than groups.

Our observations indicated that campers of all ages share responsibility for depreciative behavior. Contrary to popular belief, as evidenced in some current literature, teenagers did not commit a disproportionate amount of depreciative acts. Instead, preteenage children in groups of two or three appeared to be a major cause of expensive damage to facilities. This suggests that stricter parental supervision of children might eliminate much of the expensive vandalism problem in campgrounds.

Why Did They Do It?

The observed depreciative acts were classified as to their apparent motivation: whether they appeared to be committed for entertainment, as a matter of convenience, as sheer disregard for rules and effects on others, due to ignorance of rules, or because rules interfered with some desired goal.

Most of the nuisance acts, especially those involving pets, stemmed from ignorance of rules; but other nuisance acts such as excessive noise, violations of privacy by children, and throwing rocks appeared to be the result of deliberate disregard of the effects on others.

Vandalism of facilities most often reflected disregard, but almost one-fourth of these acts seemed to be for entertainment. For example, most vandalism by children occurred during play. Adult vandalism involving the natural environment, such as chopping on trees in the campground, was most often done for entertainment and to a lesser extent was due to ignorance of rules or the consequences of the act.

Rule violations were usually the result of sheer disregard of known regulations as exemplified by littering and use of motorbikes on campground roads and trails. In a number of incidents, rules were violated because they interfered with other desired goals. For example, a full campground often resulted in illegal camping in the picnic area.

Indifference to consequences and observance of laws only if convenient may be a primary determinant of this sort of misbehavior, especially among adults.

Thus depreciative acts are apparently committed for a variety of reasons, and

several approaches seem logical for their control. For example, better presentation of rules, education programs to increase camper awareness of the consequences of certain acts, and stricter enforcement of regulations are necessary to reduce problems of the type discussed here.

The data suggest, contrary to some prevailing opinion, that depreciative behavior is not always the result of "slobism" and vandals running wild through our Parks.

Who Was Affected?

Campground facilities, the natural environment, and other people all suffered from depreciative behavior. In total, other people were impinged upon in about 60 percent of all the depreciative incidents observed. As a result, it was surprising to note their indifference. More than 80 percent of the depreciative acts observed were committed when other people were around. In more than 90 percent of these cases, no perceptible reaction by adjacent campers could be observed. People either ignored the acts, were indifferent to the act, or did not see anything happen.

In the small percentage of cases where onlookers reacted, the most common response was to comment to others about the incident. In a few cases, people were obviously upset but took no action. Even when acts of vandalism were committed in view of adjacent campers, remedial action was observed only one time. In this case, the camper went to get a ranger. Certainly such indifference creates a climate in which depreciative behavior can and will occur with little consequence to the offender.

What Action Was Taken?

Campground rangers were present at less than 10 percent of the depreciative incidents observed. Data were insufficient to support or reject the concept that the presence of rangers serves as a deterrent to depreciative behavior, although it is believed that this is true.

In almost all of the cases in which a ranger was present and did take some action, the offender was cooperative. Indifferent or uncooperative behavior was observed in only a few cases, and this was when the offender was reprimanded for violation of campground rules. In these cases, violators complied with the ranger's instructions about two-thirds of the time.

Repetition of the act was the most common type of noncompliance after confrontation with the ranger. It appeared that repeated violations reflected camper judgments that the rules were either unnecessary or that they interfered with other recreational activities or goals.

CONTROLLING DEPRECIATIVE BEHAVIOR

It is one thing to point to problems and quite another to provide workable solutions. We do not know, at this point, how to solve all the problems we observed. However, in addition to the points suggested earlier, certain broad guidelines may be useful.

To begin, we should recognize that the campground community, like all communities, contains a broad range of deviant behavior. Problems arising from these behaviors will increase and become more complicated as the camping population grows. Old standards, rules, management policies, and approaches will become obsolete. Recognition of the problems and new efforts to cope with them are imperative.

Administrators must recognize that working with the people who use public parks is a challenge of the first magnitude. Camping in highly developed campgrounds has become a social experience; we must design campgrounds, develop policies and rules, and train rangers with this in mind as much as the necessity for preserving the environment.

The data suggest that rules intended to control certain types of unwanted behavior in campgrounds must be clearly analyzed as to their effects on recreational activities before they are implemented. If the public cannot see their worth and the underlying rationale, then these rules will most likely be violated. It is therefore important that reasons underlying rules and regulations are clearly communicated. Adoption of common campground rules and standards of enforcement by the different agencies would also help to remove some of the

confusion that exists regarding appropriate behavior.

If strengthening the police powers of park authorities is not the complete solution, it is certainly an important ingredient. Most campground rangers seem to resist the role of policeman and find it difficult to confront the public in an authoritarian manner. Yet the enforcement aspect of their job will become increasingly important. In future recruitment and training, this should be recognized.

In addition, the legal authority of most agencies is extremely limited; and unfortunately this weakness is recognized by the worst offenders. Cooperating law-enforcement agencies are often overworked and unable to respond, particularly during periods of peak use. Legal changes, whereby campground rangers could be made more effective, should be explored.

Police tactics, of course, cannot solve all of the problem without a greater degree of public awareness and cooperation. The loss of personal freedom to the average camper would be too high if we took all measures necessary to completely eliminate depreciative behaviors. But they can be reduced if security measures are backed by public recognition of the problem.

Above all, the individual camper must be made to shoulder much of the burden. Noninvolvement can no longer be tolerated. Campers must begin treating deviance in parks as they would treat it in their own front yards. They must take on the burden of direct intervention by vocally stating their disapproval of wrongdoings and, if necessary, summoning campground personnel. Campground rangers must begin to actively encourage campers to help.

EXPERIMENTAL CONTROL OF LITTERING

One means of involving campers directly in the control of a problem behavior—littering—was tested during the summer of 1970. In this study, an incentive system was used to encourage the picking up of litter, first in a movie theater and subsequently in a large forest campground.

Theater Phase

Over a 14-week period, we measured the littering behavior of children at kiddie matinees in two theaters to determine the effects of traditional antilitter measures including direct appeals, antilitter films, litter bags, additional trash cans, and the effects of new approaches such as tangible rewards contingent on antilitter behavior. Theaters were selected for this preliminary phase of the study only for their convenience as a place where alternative procedures could be tested.

We found, in general, that under normal conditions, only 16 to 19 percent of litter in the theater was properly disposed of in trash cans. Doubling the number of trash cans in the theater and placing them in more conspicuous places had little or no effect on litter disposal.

Showing a Walt Disney antilitter cartoon before the scheduled movie slightly increased disposal of litter, but to a total of only 21 percent, which actually represented no effect because it so closely approximated normal antilitter behavior.

The first real effects were noted when litter bags were handed out "for your use while in the theater," which raised the litter disposal rate to 31 percent. When litterbags were combined with firm instructions to the audience to "please put all of your refuse in the litterbags and deposit them in trash cans before leaving the theater," the litter deposited in trash cans rose to 57 percent.

However, outstanding results occurred when tangible incentives were offered for proper litter disposal. When children were offered 10 cents for every full litter bag deposited in the lobby, 94 percent of the litter in the theater was properly discarded. Likewise, when children in another theater were offered a free ticket to a special movie for each full litter bag, 95 percent of the litter was deposited in the trash cans.

These results indicate the ineffectiveness of traditional antilitter procedures (with the possible exception of litterbags and explicit, personally delivered instructions) and the dramatic effects of even a small incentive on antilitter behavior.

Campground Phase

The objective of the foregoing experiment was not to develop methods to clean up theaters but rather to determine if established principles of behavior could be applied to encourage antilitter behavior and to compare such efforts with conventional litter-control methods. As a result of the findings from the theater experiments, we conducted a similar experiment in a forest campground to evaluate the applicability of an incentive system for litter control in a campground environment.

Two types of litter were measured in the campground: that thrown down by campers and that planted by the research staff. Planted litter was necessary to insure a relatively constant level of litter and to determine which types of litter were most likely to be picked up—under both normal conditions when no incentives were offered and under reinforced conditions when the incentive system was in effect. The litter planted included beverage cans, deposit and nondeposit bottles, and crushed brown paper bags.

The campground phase of the study lasted 2 weeks. During the first weekend, under normal conditions, litter levels rose steadily from Friday through Sunday and declined slightly on Monday. During this time, all but 9 percent of the deposit bottles were picked up, while 30 percent of the nondeposit bottles, 54 percent of the cans, and 59 percent of the paper bags remained on the ground.

During the second week, we contacted seven families and offered their children small incentives for picking up litter—Junior Forest Ranger Badges, Smokey Bear Shoulder Patches, chewing gum. During this weekend, the litter count dropped, with a dramatic effect. Whereas during the first week only deposit bottles consistently disappeared, all types of litter were picked up while the incentive program was in effect. In fact, except for 5 percent of the cans, 3 percent of the paper bags, 5 percent of the nondeposit bottles, and 3 percent of the deposit bottles, everything else was collected by the children.

These results clearly indicate that for litter with a built-in value such as returnable bottles, nothing additional is needed to encourage picking up. For other types of litter, providing an incentive for collection and proper disposal is necessary. Under the incentive conditions, all types of litter had a value and as a result were likely to be disposed of properly.

The feasibility of methods such as the one presented here should be noted. The incentives handed out in the campground were worth approximately $3.00, and the time to implement the incentive system was approximately 2 man-hours. If the litter had been collected by campground personnel, an equivalent job would have taken 16 to 20 hours and would have cost $50 to $60.

Both traditional and a newly proposed incentive method for combating litter were tested in these experiments. At least in the two theaters and the campground, traditional methods were grossly ineffective compared with incentive systems. Judging from the condition of the Nation's highways, parks, cities, and forests, traditional methods have not been greatly successful in these areas either. Appropriate disposal facilities, properly designed educational campaigns, and use of litterbags are certainly important in solving part of the litter problem; but new approaches are obviously necessary if we are to approximate a reasonably complete solution.

The incentive method successfully used in these studies offers a promising approach. That such programs may result in a dramatic reduction in litter is justification enough, but the biggest payoff may be the values and behavior learned by children who have been tangibly rewarded for their antilitter efforts. Although some schools of thought might debate on philosophical grounds the value of rewards in the learning process, such an approach is well founded in theory and is substantiated by research.

CONCLUSION

Solutions to behavior problems are not easy to come by in any environment, least of all in public recreation areas where the appropriateness and consequences of many

behaviors are ill-defined. It is likely that recreation-area managers will be faced with an increasing number and variety of problems of a depreciative nature as user populations grow and diversify.

We are just beginning to learn how to cope with depreciative behavior, but one thing seems clear – conventional wisdom about who causes problems or why people behave as they do cannot be accepted as fact. Such "folklore" may be unfounded and lead to further problems. For example, *all* vandalism in parks is *not* caused by "drunken teenage punks" who blow up outhouses and rip down signs to impress their friends. However, accounts of this sort dominate some of the current literature.

Our research indicates that depreciative behavior, at least in well-developed forest campgrounds, is widespread and that *all* campers share responsibility for the problem.

Finally, the approach taken in the experimental control of littering holds promise for managers of recreation areas. By structuring the environmental factors that control behavior, many imaginative programs are possible. We need not, and must not, limit ourselves to the traditional methods for controlling inappropriate behavior.

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PERSPECTIVES ON LAW ENFORCEMENT IN RECREATION AREAS

by LAWRENCE C. HADLEY, *Deputy Assistant Director, National Park Service, Department of the Interior, Washington, D. C.*

ABSTRACT. The nature and scope of law-enforcement problems in the National Park System are of increasing concern to park and recreation area managers. A positive response by management in terms of formulating and executing a fully professional and effective enforcement program is vital for sustaining public confidence that Parks are safe for individual and family use. Law enforcement must be carried out in perspective with other management programs and developed with sensitivity to the changing nature of society and the changing needs and interests of park users.

IN THE SUMMER of 1970, the Superintendent of Yosemite National Park reported as follows about conditions in Yosemite Valley during much of the heavy use season:

> At . . . times the overriding impression is one of confusion and noise. Motorcycle groups cruise aimlessly around the Valley floor, looping through Yosemite Village and the campgrounds; they ride along the foot and bridle paths, and congregate with others of their kind in their converted vans and delivery wagons. Singly and in groups, young people drink wine on Sentinel and Stonemen Bridges, invade the meadows and panhandle from park visitors in front of the Village Store. Theft, major and minor, is common in the campgrounds. The mobile camper, unable to find space in the campgrounds late at night, wanders through the Valley seeking parking areas and other places to pull off the road for a night's rest. Auto traffic in the easterly portion of the Valley where the major public use facilities are located is confusing and frustrating to the interested sightseer who is in no particular hurry to get to any particular place.
>
> Although these impressions are generally valid, solitude and natural serenity are still possible in the Valley. Not all motorcyclists operate noisy equipment; not all of the young generation of visitors behave wantonly or intolerantly of the feelings of others; many are not drug ridden nor panhandlers. Major crime is under control and the physical safety of the majority of visitors is not a problem.

CONFLICTS IN THE PARKS

Though the situation in that Park may not be critical now, the conditions noted by the Superintendent are typical of those that are becoming increasingly more evident in other national parks.

In 1970 several areas of the Park System experienced disturbances of major proportions and severity, posing new and unique problems to park management.

In Lassen Volcanic National Park a group of Indians attempted to occupy that park and take possession of it in settlement of land claims. The activity was successfully deterred by the cooperative efforts of Park rangers, U. S. marshals, California State Highway Patrol officers and the local county sheriff staff.

At Badlands National Monument and Wind Cave National Park, South Dakota, and at Theodore Roosevelt National Memorial Park, North Dakota, groups of several hundred young motorcyclists tried to force entrance into those areas and to congregate for a weekend encampment. The local Park staffs, augmented by rangers from other National Parks and by a unit of United States Park Police from Washington, D. C., were able to maintain order and forestall a concentrated assembly of the group.

At the Mount Rushmore National Memorial, Indians engaged in a prolonged occupation and demonstration during the late summer and fall in support of grievances against the Federal Government.

In Yosemite a group of 500 to 700 young people confronted Park rangers in a near riot when attempts were made to assure quiet and good order in the Valley campgrounds. A staff of some 40 Park rangers required assistance from nearly 100 officers from neighboring police jurisdictions to restore order after the initial violence had subsided.

The parks of the Nation's Capital, administered by the National Park Service, are more and more the scene of demonstrations by scores of groups and organizations that seek to express a variety of beliefs and views on an array of issues and concerns. In May, and again in July 1970, massive demonstrations in Washington tested the capabilities of the United States Park Police in containing violence.

CHANGING SOCIETY

The United States is now moving from a rural-oriented to an urban-oriented society, and at the same time its population is trending toward a majority of young people under the age of 30.

Public use of the National Park System has risen to exceed 170 million visitors during calendar year 1970.

Urban dwellers and young people, whose attitudes toward the meaning of parks and whose needs and interests in park use differ markedly from the typical user of only a few years ago, comprise an increasingly large proportion of park visitors.

The traditional role of park manager has been keyed to a philosophy which has held resource preservation as primary and public use (the visitor) at best secondary, if not substantially lower in priority, as an objective of management.

Urban visitors bring urban problems to parks and are forcing change in park management.

The traditional functions of the Park rangers have been oriented toward protecting park resources and providing interpretive services to visitors. This has led to recruitment of rangers largely from the natural sciences, history, archeology, landscape architecture, etc. These backgrounds are unsuited to the emerging situations, which demand involvement with the urban problems that are more and more evident in the Parks, especially in law enforcement.

DILEMMA

Statistics on crime in the National Parks (table) clearly suggest the need for positive action by Park managers to achieve professionalism in law-enforcement programs to deal with hard crime, and to make innovations in management programs that offer alternatives to law enforcement as the ultimate action. Failure on either count may increase the risk that the public will lose confidence in the Parks as places safe for family use—a suggestion that has already been voiced in public discussions of the issue.

The dilemma that is presented to park management is identical to what faces university administrators, city officials, governors of states, and virtually every public and corporate official today. The changing nature of American society is causing millions of the population to question the validity of accepted traditions and values.

That segment of our society under 30 persistently hold the view that poverty in affluent America is intolerable; that black Americans have been shamefully treated and deserve equal sharing of opportunities; that National goals are materialistic, based

Table.—*National Park Service law-enforcement summary, 1966-70*

Criminal action	1966	1967	1968	1969	1970	Increase
PART I CLASSES:	*No.*	*No.*	*No.*	*No.*	*No.*	*Pct.*
1. Criminal homicide	4	6	9	14	8	100
Murder and non-negligent manslaughter	0	4	4	4	5	
Manslaughter by negligence	4	2	5	7	3	
2. Rape	17	41	48	56	34	100
3. Robbery	99	168	235	203	188	89
4. Aggravated assault	87	199	258	234	258	196
5. Burglary—breaking and/or entering	244	394	476	512	896	267
6. Larceny (except auto)						
$50 and over in value	460	539	802	1,282	1,593	246
Under $50 in value	1,255	1,955	2,430	3,050	2,773	120
7. Auto theft	96	97	140	134	154	60
Total, Part I classes	2,262	3,399	4,140	5,485	5,904	161
PART II CLASSES:						
8. Other assaults	20	21	39	30	51	155
9. Forgery and embezzlement	2	2	6	8	2	
10. Fraud	8	8	15	37	53	562
11. Stolen property—buy, receive, possess	24	30	74	114	38	58
12. Weapons—carrying, possessing, etc.	258	170	172	247	285	10
13. Sex offenses (other than No. 2)	96	89	65	63	41	–49
14. Narcotic drug laws	11	48	208	366	700	6,263
15. Liquor laws	415	525	574	787	953	129
16. Drunkenness	2,791	2,307	1,521	475	521	–81
17. Disorderly conduct	957	1,021	1,288	1,155	1,692	76
18. Driving under influence	273	272	227	365	541	98
19. Road & driving laws (moving; other than No. 18)	31,161	23,235	29,757	34,207	37,513	20
20. Parking violations	24,477	20,870	31,030	46,889	38,483	57
21. Traffic & motor vehicle laws (except Nos. 18-20)	3,765	3,088	4,245	6,619	5,631	49
22. Fishing regulations	254	255	443	688	827	225
23. Boating regulations	424	685	758	1,065	1,039	145
24. Protection of wildlife; firearms, etc.	755	490	593	1,984	2,173	187
25. Preservation of natural features	1,643	587	788	1,274	4,604	180
26. Destruction of Government property	83	119	276	194	179	115
27. Vandalism (other than No. 26)	152	227	219	217	331	
28. All other offenses: littering, fires, pets, miscellaneous	1,439	3,114	7,282	10,626	16,957	1,078
Total, Part II classes	69,008	57,163	79,580	107,410	112,714	63
All criminal actions	71,270	60,562	83,720	112,895	118,618	66

in the concept that public decisions are influenced primarily by economic considerations; that our Nation's basic resources have been plundered and abused for personal gain at the expense of National well-being for this and future generations.

A national dialogue along these lines has been taking place in varying degrees of intensity across the land for nearly a decade. Out of it has emerged the fixing of labels by opposing sides: "hippies" on the one hand and "the establishment" on the other. Park managers fall largely, if not entirely, in the latter category and are, by implication, resistant and unyielding to change.

INNOVATIONS IN MANAGEMENT

Within the Park Service, however, there are examples of innovations in management that reflect awareness and responsiveness to the changes occurring in American society.

The record of increase in crime in the National Parks has caused the Service to move agressively to attain full professionalism in law enforcement. After comprehensive study of the problem in the Park System and evaluation of our effectiveness and capability of dealing with it by expert consultants from the International Association of Chiefs of Police assisted by repre-

sentatives of our own U. S. Park Police, we are proceeding with a program as follows:

- In this fiscal year the United States Park Police force in Washington will be increased by 40 positions. This added strength will permit formation of a police cadre capable of being dispatched to areas of the National Park System throughout the country to assist Park rangers in cases of special need such as have occurred in recent years.

- The law-enforcement program will be strengthened by providing professional law-enforcement assistance within the Washington region and Park organization structures. Maximum reliance is being placed upon the expertise and professional ability of officers of the United States Park Police to provide leadership and program direction.

- At the Washington level a Division of Law Enforcement has been created, headed by an inspector, United States Park Police. At the regional level a law-enforcement officer will be assigned to the staff of each of the Region directors. The position will be filled by an officer of the Park Police at the lieutenant-captain grade.

  At the Park level a law-enforcement officer will be assigned to the staff of the superintendent in Parks where law-enforcement problems are identified as major in degree and proportion. We anticipate that 15 to 20 Parks need professional police assistance during the heavy travel season. The positions will be filled by the assignment of a Park Police officer at the sergeant-lieutenant level.

- A comprehensive law-enforcement training program has been designed and initiated that will reach 225 ranger candidates and selected management personnel. Before the opening of the travel season this year, 50 Park rangers from all parts of the country will have completed 540 hours of basic police training at the Service's Washington Center.

- Since seasonal rangers bear the brunt of the responsibility in accomplishing our objectives in public-use management during the heavy travel season, a special training program in law enforcement has been developed to reach a minimum of 100 seasonal candidates from selected areas.

- An intensive 8-week training program heavily oriented toward police management and administration is being designed for supervisory ranger personnel from areas experiencing major law-enforcement problems.

- A seminar in law enforcement will involve top field managers of the Service in exposure to law-enforcement problems in our society. Its purpose is to develop a policy and philosophical base upon which to formulate and execute the Service's law-enforcement program.

The effort that is being mounted to achieve an effective posture in law enforcement is designed to meet a primary objective of management of the National Parks: to achieve ". . . proper use, management, government and protection of, and maintenance of good order in . . ." the National Park System.

FOR EVERY CITIZEN

The purpose of the law-enforcement program of the National Park Service is to assure for every citizen a park experience that is personally meaningful, free from apprehensions about the safety of his person and his property.

Law enforcement must be viewed in proper perspective and relationship with all other Park management programs, and must be able to withstand judgments as to viability and relevancy in accordance with the public interest. The National Park Service has accepted as a guide in formulating management programs—including law enforcement—the philosophy of Thomas Jefferson, who wrote:

> . . . laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths discovered and manners and opinions change, with the change of circumstances, institutions must advance also to keep pace with the times . . ."

The National Park Service is such an institution that must ". . . advance . . . to keep pace with the times . . ." We believe we are doing so in upholding our law-enforcement responsibilities.

We are committed to measures that will achieve a professional stance in law enforcement through adhering to the highest principles of justice and the preservation of individual rights and liberties.

The record demands timely and equitable enforcement of Park regulations and other laws. But it is expected that enforcement actions be executed with that degree of professionalism that does not impair the quality of park experience that the public rightfully expects.

Finally, in further observance of Jefferson's caution that institutions change, the National Park Service has sought innovations in management programs to meet the special needs of special segments of our society.

In the National Capital Parks of Washington, D. C., and at Mount Rainier and Olympic National Parks in Washington State, funds especially appropriated by the Congress provide free busing for minority and disadvantaged children into the nearby Parks from Washington's inner city and from the depressed neighborhoods of Seattle and Tacoma. Special programs ranging from rock-music concerts to interpretive programs to camping and hiking outings are offered. This effort has been accepted enthusiastically in its initial application and offers encouragement that it should be extended to other Parks throughout the country. In Washington, D. C., it has proved to act as an effective deterrent to vandalism in the parks.

A recently inaugurated program known as Volunteer-in-the-Parks offers an opportunity for youngsters, and older people as well, to work as volunteers in Park programs. Volunteers serve without pay but receive compensation for costs of commuting, meals while on the job, and the cost of needed uniforms or required special clothing. The response has convincingly demonstrated the interest of citizens of every age and background in public service ranging from period costumed interpreters in historical areas of the Park System to performers in craft demonstrations to manning of public information desks in Park visitor centers. The Volunteers not only get a "piece of the action" but are found to be an effective non-bureaucratic means of communicating with park visitors.

These measures are challenging park managers to seek new ideas and fresh approaches in meeting the needs of today's public. They suggest interesting possibilities in responding to the unconventional interests and desires of today's youth such as recently occurred at the Padre Island National Seashore in Texas. There, 3,000 young people from the Corpus Christi area asked for, and received, permission to stage a weekend rock festival on the beach. The event was staged without incident, although accompanied by the array of bizarre behavioral patterns associated with such gatherings. At the close of the affair the Superintendent, who initially viewed it with apprehension, reported that the kids effectively policed their "happening" with a minimum of need for surveillance by the Park staff—and they left the beach cleaner than it was when they arrived.

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COMMUNICATING WITH RECREATIONISTS

by J. ALAN WAGAR, *Project Leader, Environmental Interpretation Research, Pacific Northwest Forest and Range Experiment Station, USDA Forest Service, in cooperation with the College of Forest Resources, University of Washington, Seattle.*

ABSTRACT. Recreationists are free to ignore many of a land manager's communication efforts. Greatest effectiveness can be expected for presentations that are dynamic and are tailored to the interests and other characteristics of selected visitor groups, that permit participation and reward learning, and that provide both an idea of what is coming and a framework to give it coherence.

MOST OF THE ORGANIZATIONS responsible for forests and related resources find that recreationists are their major public contact, making communication with recreationists a matter of vital importance.

Reasons for communicating can vary. Communication may be designed to serve the organization, perhaps by improving its public image or by gaining understanding for its policies. Or communication may be designed primarily to serve recreationists or other publics by enhancing their experiences. Still other communication efforts —such as those to inform people about rules and regulations—may serve the needs of both the organization and the recreationists.

The research in my own project is now concerned primarily with the effectiveness of efforts to interpret the environment to people. In this, emphasis is on communications that benefit recreationists and others, either directly by enhancing their on-site experiences, or more indirectly by helping them know enough about the environment for responsible citizenship, thereby contributing to thoughtful public actions that help maintain the flow of benefits from our natural resources. This is a new direction for us. However, research and experience from a number of fields bear on the effectiveness of the communications involved in environmental interpretation.

Perhaps the first principle in these communications, especially those with recreationists, is to remember that we are dealing with non-captives who can stay or leave as they wish. Although the professionals in recreation generally think of it as being constructive, having serious purpose, and being "good for you," the recreationists themselves typically seek diversion, enjoyment, even amusement. They are not likely to tolerate our communications solely out of some great thirst for self-improvement.

The general extent to which visitors can be reached by interpretation is indicated by a study made in Yellowstone National Park *(McDonald 1969)*. Of the people who visited the park, 56 percent attended visitor centers, 11 percent attended campfire programs, and 9 percent used nature trails. Approximately 10 percent of the visitors stopped at wayside exhibits, and less than half of these people read the signs. A large proportion of the visitors simply were not

reached by any of the interpretation provided.

MOTIVATION & INTEREST

If the number of people reached is to be increased, both motivation and interest are of central importance.

By choosing to seek recreation, visitors already demonstrate some motivation; but this may have a Jekyll-and-Hyde character about it. On one hand, the recreationist normally comes looking for enjoyment and is predisposed to defining the experiences he encounters as enjoyable. On the other hand, he may wish to escape anything that appears to be "heavy going." If what we offer is not truly interesting and a source of the delight the visitor came seeking, he may simply drift away in spite of his initial predisposition toward enjoying whatever he finds.

As a means of communication that motivates visitors, the ideal is to have a gifted interpreter or guide for each visitor or small group of visitors. In addition to being dynamic and conveying the personal enthusiasm of the interpreter, personal presentations can be designed so they permit participation and response by the visitor, providing feedback to the interpreter and his organization.

This feedback is the key to flexibility; it permits presentations to be adjusted to the interests, knowledge, misconceptions, attention spans, and other characteristics of the audience. If presentations cannot be tailored to the audience, many people may simply lose interest.

What the visitor defines as interesting will be conditioned strongly by his everyday world. As Tilden *(1967)* expressed it: "Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile." We must start with what the visitor already knows and feels.

Finding this starting point is often difficult for land managers whose professional training and years of experience with rural resources make many things seem self-evident. But what seems self-evident to the land manager may lie mostly outside the experience, knowledge, and feelings of the urban people who comprise a growing majority of our visitors.

Resource managers are also affected by the standards set by other communicators. For example, the yellowing sheet of campground regulations posted on the weather-beaten bulletin board just may be overlooked by the visitor who is saturated with TV advertisements that have living color and the best attention-getting techniques that money and the FCC permit.

RESEARCH FINDINGS

Some of our recent research in the Pacific Northwest shows just how important the means of presenting information can be. For interpretive exhibits, our interviews with people at five visitor centers showed that interest depends greatly on the extent to which exhibits are dynamic in some way rather than inert. Exhibits with motion, recorded music or speech, shifting lighting, or three-dimensional effects were rated as interesting much more than average. Conversely, those using mounted photos and printed texts were selected as interesting much less than average. This is sobering when you realize how much resource managers have relied on mounted photos and printed labels to communicate with recreationists.

The same study also showed that people would much prefer to hear information than to read it. In addition to taking less energy than reading, listening permits the visitor to concentrate his attention on the scene or object of central interest. Mahaffey *(1969)* found similar results at a historic site in Texas.

A number of organizations seem to have come to the same conclusion. Many museums, visitor centers, and zoos now have message repeaters at selected exhibits. And some museums rent headphones that pick up messages from inductance loops at selected exhibits.

Portable tape-players can also be used in many situations, and several companies now offer guided walking or auto tours recorded on cassette tape. These are available for many of the major cities of the world, for several National Park Service areas, for

Niagara Falls, and other attractions. In the Pacific Northwest, we are studying ways to adapt and enhance the effectiveness of cassette tape-players for interpretation in National Forest settings. In addition to determining how well visitors like recorded tape presentations for nature trails and auto tours, we are also investigating how the structure of the presentation affects learning.

If we want visitors to learn specific facts or concepts, then two branches of learning theory are pertinent. One, espoused by Piaget *(1970)*, maintains that participation is essential for learning. For a child this may be highly direct—as by touching a newly discovered object or putting it in his mouth. Later, participation may be increasingly abstract; but, according to Piaget, it must still take place if learning is to occur. As an illustration of this concept, many educators now use the "discovery method" of teaching some subjects. In this, they use a series of questions to lead the student into discovering facts or relationships for himself rather than being told directly. How much involvement and participation are permitted in communications by land managers?

EMPHASIZE PARTICIPATION

A second and equally pertinent branch of learning theory comes from the work of B. F. Skinner *(1968)* and other behavioral psychologists. They note that people persist in doing the things they find rewarding.

Piaget's emphasis on participation is not at all incompatible with Skinner's emphasis on reward. This was nicely demonstrated by our experience with a question-and-answer device we call the recording quizboard. When we installed this in a National Park visitor center, children began playing it within seconds, and it continued as their favorite exhibit until we removed it. This came as a surprise, since our quizboard included only written questions and answers about the other exhibits, and these other exhibits were extremely well done. However, the quizboard was the only exhibit in the building that permitted participation.

By their enthusiasm, children and, to a lesser extent, adults demonstrated that participation was highly rewarding and created sufficient motivation to hold their attention, even though they were a non-captive audience. There remains, however, the matter of harnassing this motivation to convey a message. Pinball machines, for example, permit participation but do not convey much information.

One approach lies in making the reward contingent upon learning. If interacting with exhibits is fun or rewarding, simply set exhibits up so that participation can continue only after the player correctly answers a question demonstrating that he has learned a portion of what we want him to know. The portions conveyed in this manner can be arranged to convey complex concepts. This, of course, is the basis of teaching machines and programmed learning.

Even after the novelty of interesting equipment has worn off, being shown that the last answer was correct is reward enough to maintain interest and enhance learning. In fact, on the basis of this, coin-operated question-and-answer machines are now located in many public places as a commercial venture.

PROGRAMMED INSTRUCTION

Although reinforcement by identifying correct answers has been used in displays designed to identify birds or other objects, it has seldom been used to convey more complex concepts to non-captive audiences like those found in recreation settings. An exception is the work of C. G. Screven *(1969)*, a behavioral psychologist. In studies at the Milwaukee Public Museum he has used programmed instruction techniques to greatly increase what visitors learn from a rather detailed anthropology exhibit.

Some visitors were given a portable tape-player connected to an answer board. When started, the tape-player told the visitor what to look for, explained a point to him, asked a question about it, and then stopped. When the visitor selected the correct answer on the answer board, the player started again, rewarding the visitor by telling him his answer was correct, and then continuing with additional directions, explanations, questions, and identification of correct

answers. Visitors who received this guidance averaged about 75 percent correct on an examination to test their knowledge of the exhibit, compared with an average of about 25 percent for visitors who saw the exhibit without this guidance.

Based in part on Screven's work, we developed and tested programmed signs for a nature trail in the Pacific Northwest. For the sixth-, seventh-, and eighth-grade students who used the trail, signs with branching programming resulted in 20-percent higher test scores than unprogrammed signs that included the same information. In the branching program, selected signs explained a point and at the bottom included a question with three answers. According to the answer selected, the trail user was directed to one of three signs on down the trail. Signs corresponding to wrong answers provided supplementary information and then directed the user to the sign to which a correct answer would have directed him.

In addition to showing the effectiveness of programmed presentations, Screven's work in Milwaukee provided two other results. Using a short examination to measure knowledge about exhibit content, he tested some visitors only after they saw the exhibit, others only before they saw the exhibit, and others both before and after they saw it. Surprisingly, visitors who had no guidance through the exhibit scored no higher than those who had not even seen it. This suggests that many efforts to communicate through exhibits are totally ineffective. In addition, with no other guidance through the exhibit, visitors who had received a pre-test scored noticeably better on a post-test than those not given a pre-test. By supplying ideas about what to look for, the pre-test apparently "preprogrammed" visitors and provided them with a framework on which to build.

This matter of preprogramming may have wide application in our communication efforts. It is used extremely effectively at Colonial Williamsburg, where the visitor is urged to see the orientation movie "The Making of a Patriot" before he visits the restored buildings. Photographed right in the restored part of Williamsburg, this portrays such figures as George Washington and Thomas Jefferson in the history-making events leading to the American Revolution. Then, as the visitor goes through the restored town, he already has vivid mental imagery of the events that took place at the powder magazine, the Raleigh Tavern, the Capitol, etc. The movie provides a framework that helps the visitor organize, comprehend, and retain the information he is given.

OTHER WAYS

Frameworks can be provided in other ways. At the Pacific Science Center in Seattle, cartoon story lines are often used in conveying the concepts of science to young visitors. Jerry Dotson, program director says *(personal communication 1970)* these stories help maintain interest and tie ideas together until the young visitors begin to understand the concepts involved.

In these stories, a "projective" technique is also used to permit a young visitor to volunteer his opinion without much risk of being wrong. In the story line, a cartoon character such as Snoopy is often introduced and shown to make a few mistakes of his own. Then, instead of being asked "What would *you* do in this problem situation?", children are asked "What do you think *Snoopy* would do?" For an inappropriate answer, the instructor can say, "He might. Let's see what would happen if Snoopy did that." If it turns out badly, it is Snoopy's problem, not that of the child who volunteered.

Adults may be even more concerned than children about being wrong or looking ridiculous. This may explain why they often examine a quizboard or other participation device without touching it. This leads to my final point concerning communication with recreationists.

Different people will respond differently to the same stimuli, making averages somewhat misleading. Tilden *(1967)*, for example, has emphasized that interpretation for children "should not be a dilution of the presentation to adults, but should follow a fundamentally different approach." He noted that children often have an "eagerness for pure information" whereas adults have a "slight aversion to it." For

reaching a variety of people, a variety of communication techniques will be needed.

SUMMARY & CONCLUSION

Because recreationists are free to ignore most of the communications directed toward them by land managers, the effectiveness of conveying this information often depends on how much motivation and interest can be generated. The ideal situation is to have a personal interpreter or guide who can tailor presentations to the people at hand. However, the effectiveness of unmanned presentations can be increased if they include some of the attributes of a live interpreter. These include dynamic rather than inert presentations, flexibility and feedback that permit diagnosis of the visitor's knowledge and interests, and tailoring of presentations to the characteristics of different groups of visitors.

Effectiveness of communications can also be increased by providing for participation and by making it rewarding for the visitor to learn what has been communicated.

Finally, retention of information can be improved by providing the visitor with an initial framework that alerts him to what is coming and then gives it coherence.

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FACILITY REHABILITATION

by EDWIN H. KETCHLEDGE, *Professor, New York State University College of Forestry at Syracuse University, Syracuse, N. Y.*

ABSTRACT. Restoration of vegetation on damaged sites is the most perplexing challenge in facility rehabilitation. In the Adirondack Mountains, the ecological impact of recreationists on the natural environment has become critical in two high-quality interior areas: on the steep higher slopes where trails soon become eroding stream channels, washing away the thin mountain soils; and on the open summits where the fragile alpine communities are trampled by traffic from below. Our research efforts of 6 years have yielded a technique for restoring the deteriorating summits. We are trying to involve the largest regional hike-climbing organization in a sustained program of trailsmanship to assist the Environmental Conservation Department in effecting vegetational controls.

THE TERM "facility rehabilitation" may be interpreted in numerous ways to mean a variety of things. Vegetational restoration requires two essential inputs: first, acquiring the basic ecological understanding (the raw data) of the plant communities to be manipulated; and second, developing the technical skills and logistic support to effect the desired changes (the program). In our research efforts in the Adirondack Mountains of New York State, we have accumulated sufficient field data over the past five summers to warrant an attempt at the second step, translating our research phase into an action program of vegetational restoration.

The novelty of our overall program in vegetational restoration in the Adirondacks is our attempt to involve established hiking clubs in carrying out field trials utilizing the basic ecological information we have developed so far. We are continuing our research on the fundamental biological and environmental questions; but meanwhile, without further delay, we are trying to put into action a corrective program based on the data gathered so far.

My immediate concern over the last several years has been the ecological crisis created by the overuse of certain high-quality recreational lands in the High Peak region of the Adirondack Mountains. The damage inflicted on the landscape in the 1960's has become so intense that in places it threatens the ecological integrity of these sites; indeed, some are degraded beyond repair. In our close personal associations with the Adirondack Mountain Club and with the Adirondack 46ers, Dr. Leonard and I were aware of frequent discussions among recreationists themselves about the magnitude of the environmental deterioration they were in part causing on some of the highest peaks.

We felt that if we could publicize the problem to the using recreationists in the region, we might be able to exploit their concern, to direct it toward constructive restoration of the resource. Accordingly, we reported our findings in THE CON-

SERVATIONIST, official publication of the New York State Department of Environmental Conservation, a magazine of national reputation with circulation over 100,000. It was the overwhelming public response to this article that opened the door to effecting the action phase of our studies.

Because this article explains the nature of the facility-rehabilitation problem we faced, I am presenting much of it here as background to our follow-up program.

THE IMPACT

(From *The Impact of man on the high Adirondack country*, by E. H. Ketchledge and R. E. Leonard, in THE CONSERVATIONIST 25 (2): 15-18, 1970, with permission of the New York State Department of Environmental Conservation.)

Resource managers now realize that forest lands used for recreation have a specific carrying capacity for people.

In truth, the ecological impact of vacationers and recreationists on the landscape is even more pronounced than that of wildlife on their habitat. Moreover, whenever the ecological balance is delicate and precarious to start with, environmental pressures from human forces are magnified, and even slight disturbances may in time lead to outright destruction of the natural environments. When that happens, it seems that man and nature are in full battle. Such is the story of man's impact on the Adirondack High Country, our theme on the following pages.

The two of us who here share our thoughts with you first became aware of the developing conflict between man and nature in the Adirondack High Country not as professional foresters and biologists but rather as forest recreationists. In our free time, hiking over the high peaks, we were struck by the severe trail erosion we encountered on all too many of the high mountain slopes. We found even more disturbing the widespread destruction of the fragile plant communities on the alpine summits, which were being trampled to death by the ever-increasing trespass of mountain climbers.

We felt professionally obliged to spend some time working on a solution. We appealed to the United States Forest Service for assistance in investigating the problem and, through their Watershed Environmental Research unit at the College of Forestry, have received their support from the start. Now, after five summers of working intermittently on the problem, we feel we have some answers that will enable forest resource managers in the Northeastern States to control and to a degree alleviate some of the environmental problems in the High Country.

The first question we faced was just how severe and widespread was the destruction. Perhaps it was only a local situation on the few favorite peaks we had been climbing recreationally at different times of the year. During our first summer on the study, then, we individually or together inventoried all 46 peaks over 4,000 feet elevation and examined every mile of trail in the High Country. It turned out our first fears had been well-founded: erosion was in fact geographical in extent and varied from minor to severe on different peaks. In a few cases we were, and are, losing our scenic summits fast, and some sections of trails are already beyond repair. Something obviously had to be done. Based on our reconnaissance, we decided to look into two things: to study the basic ecological causes of the situation, hopefully to get ideas on long-term solutions, and at the same time to find some temporary, expedient way to minimize the existing deterioration before it got much worse.

Trail Erosion

Trails, wherever they may be, are sure to become eroded with use; that is to be expected, and ordinarily is no cause for alarm. But, in the High Country we have a very unusual combination of critical circumstances. First, the slopes are steep, often very steep and precipitous, and the soils wash out quickly if disturbed. The soils themselves are unusual; because of the vast quantities of water moving downslope through them, they are extremely unstable and have little internal strength; moreover, they are typically shallow, particularly at the higher elevations, and have a high content of partially-decayed organic material which washes out quickly. Because

of the increased rainfall on these islands in the clouds, each trail soon becomes a watercourse cutting deeper with each successive storm until bedrock is exposed, generally a matter of only a few dozen years. Thereafter the waterflow undermines the soil bank on the down-hill side of the trail, thereby ever widening the cut. Hikers, trying to avoid the mud and water in the bottom of the trail, tend to walk on the side of the bank, accelerating the erosion. In short, trail erosion is speeded up in the High Country, and is a problem of greater magnitude than in the flatter, rolling hill and lake country elsewhere in the Adirondacks.

Trailed Peaks

Twenty-six of the 46 peaks have a marked trail to the summit, a trail which consequently bears the brunt of hundreds or thousands of mountain hikers who come to the area from all parts of the Northeast specifically to enjoy the High Country. On these particular trails and their crowning summits we have an ecological crisis on our hands resulting from the explosive interest in mountain hiking.

Two forest types cover the mountain slopes: spruce-fir forests, the natural type, and paper birch forests, the disturbance type. For our study, we needed to know more quantitatively how severe the erosion problem was in each of the two, so we selected a section of trail representative of the average condition in each and studied the two. Our major question was simply how fast does the typical trail wash out. By visual judgment we had already recognized four stages in the process of trail erosion:

Stage 1. Vegetation on forest floor dead and surface litter being washed out.

Stage 2. Tree roots exposed and surrounding soil layers disappearing.

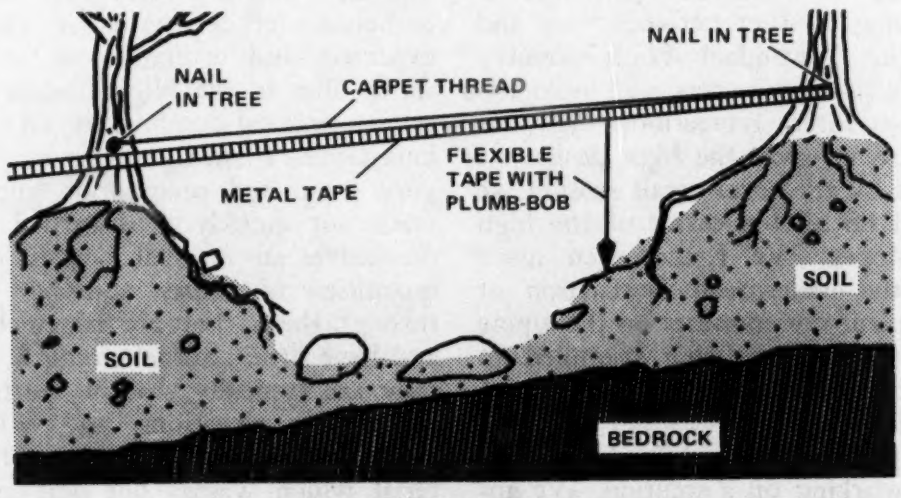
Stage 3. Unprotected lower soil level below tree roots exposed and eroding.

Stage 4. Soil mantle gone and bedrock exposed: subsequent erosion lateral into bank.

As characteristic of conditions in the post-fire paper birch stands, we selected a section of the Mt. MacIntyre trail of 21 percent slope and at the 3,000-foot level where erosion was at the third stage. Specifically, we wanted to determine how much the trail was lowered each year by the gradual washout; that is, how much soil was actually removed from the site. The technique we used at four locations is shown in figure 1.

When we put in the study plots we deliberately selected stage 3 to measure, the stage we judged to be the fastest. But, in hindsight, we hadn't expected the soil loss and subsequent lowering of the trail to be as significant as it turned out to be. The

Figure 1.—Cross-section of a trail, showing the method used for measuring trail lowering due to erosion. The trail profile was measured at 2-inch intervals along the metal tape.



average loss, including the edges of the cuts where erosion was just starting, was exactly one inch a year, a startling amount figuring the many miles of trail traversing the mountain sides.

After four years of periodic measurements we found not unexpectedly that most of the erosion occurs during the summer season. Some of the erosion is due to frost action which tumbles soil particles off the banks in the spring and fall, and quite a lot certainly is due to washout by rain. But after studying three trails for days on end, in all kinds of weather, and at all times of year, we believe the greatest share of the disturbance is due to the pounding from the hikers' boots, particularly those with the cleated Vibram-type soles. The constant cutting-in of boots roughens the surface, thereby creating an easily eroded topography. With each step of the hiker, soil is depressed further into the bottom of the cut, where the stream flowing downhill in the trail during and after a rainstorm carries it off the slopes.

Meanwhile, we set up a similar study in a spruce-fir stand at 3,400 feet near Lake Arnold on Mt. Colden. The forest there had been logged about 1920 prior to its acquisition as part of the Forest Preserve but the second-growth pole-size stand is vigorous and healthy, and the site not damaged directly by the harvesting. The trail in this case is the old logging road, of only modest steepness: 14 percent slope. Although only about 35 years old, practically the entire section of trail is in erosion stage 3. For our study this time we changed the arrangement of our profile lines to run across the trail at an angle in such a way as to tell us not only how much the trail was being eroded downward but also how fast it was widening sideways.

Again we found severe lowering of the ground level, this time slightly over an inch a year. More startling was our discovery that the trail was widening at essentially that same rate! Thus, once downward cutting begins, lateral erosion may keep pace with it. Trail erosion, then, is a two-dimensional problem—a vertical dropping of the trail surface, as expected, but also a horizontal movement at approximately the same rate.

Trailless Peaks

One would perhaps think that the 20 high peaks without maintained trails would be immune to the problems under discussion here. Such is not the case. The latent pioneering spirit of independence in each of us is best expressed among forest recreationists by choosing one's own route and destination, free of the oft-crowded trail and away from the noise and disturbance generated by fellow woods-travelers. But there are not that many different routes possible up the remaining "trailless peaks," and by the 1960's most of our isolated summits had their own multiple versions of so-called "wilderness trails," where the footsteps of hundreds of independent climbers have left their respective marks on the forest floor, in many cases initiating a problem of erosion. One need not be an expert woodsman to notice most of these routes; it turns out therefore that they receive a great amount of unintended use.

As a consequence, unmaintained trails have appeared on the last of the 46 peaks over 4,000 feet elevation. Indeed, the problem of erosion on these less-traveled trails is more pronounced in one sense than on the authorized trails; several of the peaks have many trails converging on the summit. Now they get worse each year because novice climbers walk over several of them trying to find which one actually leads to the summit. Until a single one is selected to be marked and maintained as the official trail, each of the many trails will continue to erode and threaten the ecological and aesthetic integrity of the remaining summits. It seems a shame we can't leave some of our mountain peaks isolated and alone in a true wilderness condition, but so long as people demand to climb them, the best we can do is minimize their damage, concentrating the disturbance on a single trail that can be supervised and maintained properly by State forest rangers.

Disturbing as the trail problem is, the two of us feel optimistic about it all for a simple reason. The resource managers already know fairly well how to handle the ecological degradation; the rangers know how to locate trails wisely on a gradual traverse upslope instead of going straight up and down; they know how to put in

water bars at regular intervals to shunt the water flow off the trails onto the forest floor where it can be slowly absorbed. To a great extent we already have the technical know-how, though admittedly we have yet to devise aesthetically pleasing techniques to preserve the naturalistic settings along the trails. What we frankly don't have is the necessary staff of trail rangers to handle the upkeep problems created by the hordes of recreationists now exploring the mountain slopes. Fiscally we are budgeted for the 1950's while our problems are those of the 1970's. In view of the exploding interest in forest recreation, realistically we need to expand our financial and logistic support for trail maintenance and for related environmental protection.

Summit Destruction

We face an altogether different and more complex problem in the matter of ecological destruction of our higher summits.

The key to understanding the problem here is an appreciation of the fragile nature of these arctic-like plant communities crowning the higher Adirondack peaks. One might think that a group of plants tough enough to withstand the extreme environmental condition prevailing on a wind-swept mountain summit would certainly be able to take the trampling of hikers. Such is not the case. Cold temperatures, short growing seasons, infertile soils and drying winds are one thing, but the summer-long physical pounding under thousands of human feet is too much to expect here where growing conditions alone are so treacherous.

The complicating factor in the alpine zone topping the High Country is the absence of a true meadow vegetation protecting the site; that is, there is no tough sod of intertwining grass roots binding the soil together underground. The reason for this is reflected in the uniqueness of the alpine habitat: It really is an inverted bog.

Summits Resemble Bogs

In its simplest terms a bog is nothing more than a wet depression wherein peaty, saturated soils develop. The types of plants and other life forms inhabiting any particular bog *(THE CONSERVATIONIST, June-July 1964)* depends upon the particular chemical-physical characteristics of each situation, but one highly specialized plant group is universally present in all our norther bogs, namely sphagnum moss. It is the group responsible for peat formation *(THE CONSERVATIONIST, April-May 1961)*, for the deep deposits of peat moss now being used as a soil emollient. As the crowded plants, only a few inches tall to start with, grow upward each year, their older stems die off or they become buried in their own stems and leaves; in their upward movement they leave behind a stationary wake of their own remans, so to speak, which settles into the compact layers of peat now familiar to every gardener.

Peat in itself is not a good substrate for plant growth. It is lacking in nutrients, though it will retain them nicely when sufficient fertilizer is added. It is very acid in chemical reaction and must be heavily limed to make a "sweet" soil. The empty leaf cells will retain great amounts of water, and once so wetted, peat remains damp several days, whence part of its value in gardening. The combination, then, of sour and wet is what makes the bog condition in which only a few specialized types of plants can survive.

As for the Adirondack summits, most of which are rounded mountain tops, they stick up into the sky like blotters intercepting moisture-laden clouds constantly floating by. Theirs is a misty, damp environment much of the year, a good growing condition for sphagnum mosses. Moreover, accumulated dead plant remains decay very slowly in these cold, sub-arctic ecosystems; the undecayed plant matter creates an acid, mucky soil, the type of substrate on which sphagnum does well to the exclusion of most other plants. The final result of this interaction of environmental condition is that sphagnum moss, not grass, turns out to be the meadow-forming plant on our mountain tops. It is the ground matrix in which all other plants are rooted. It is the ecologically dominant plant controlling the site and directing vegetational development.

In brief, the summit may be visualized as a thin veneer of sphagnum bog arching over the summit rock like a giant, upside-

down bowl, a concave cap of bog environment sitting inverted on a mountain top, of all places!

The significance here is that sphagnum lacks roots and woody parts. The delicate aerial shoots are entirely soft and herbaceous; the lower stems in contact with the ground quickly die as they shade out, and crumble into peat. Such a fragile plant, however well-adapted to the natural environment prevailing on the summits, cannot take the new phenomenon appearing there, the advent of the hordes of mountain climbers and hikers criss-crossing all over the mountain tops. In the alpine environment, footprints oft become indelible tracks in the tundra meadow, spots which die back and soon start to erode out. The fundamental ecological truth of the situation is simply that the alpine-zone plants rooted in the sphagnum matrix are eventually trampled to death by the hikers walking around and enjoying the view from different vantage points on the open summit. Once so exposed, the unprotected sphagnum matrix is quickly killed as well, and soon the black, mucky component in the matrix leaches out in the rains, leaving the near-inert peat stems and leaves. Thereafter erosion is next to impossible to stop so long as the site is continually subjected to the pressures of human trespass.

The alpine trespass-capacity, as we personally term the limited carrying capacity of such fragile environments for people, is much lower than the current level of traffic flowing over every one of the 12 higher peaks having tundra conditions at their summits. Therein lies the cause for the approaching destruction of our precious arctic landscape in the High Country: too many people for the precarious environment to handle.

If we can't slow down the flow of recreationists to the summits (a question that should remain open and debated, we personally believe), then what can the ecologist do to lessen the human impact on these few alpine jewels? The answer, obviously, lies in countering the ecological degradation inflicted upon the landscape; but how?

We sought to find out in two ways. Our basic premise was that if the natural vegetation could not cope with accelerating human disturbance, then we would have to (1) supplement the native flora with one or more hardier introduced species of plant better able to withstand the pressures, and (2) increase the energy flow and health of the community by the addition of essential nutrients via fertilizers. We assumed, of course, that saving a summit community somewhat altered with a non-native species was a lesser evil than losing the entire alpine zone outright, as was so evidently happening all around. We hoped that if we could arrest or abate the erosion, perhaps then by improving the site fertility we might get a catch of local species to seed in again and take over once more, as was going on naturally long before the recreationists arrived. Idealistically, our long-term goal was to restore the summit to the pre-recreationist condition.

Mt. Dix Test Area

To that end we selected the sixth highest Adirondack peak, Mt. Dix, elevation 4,857 feet, as the test peak. It has three stretches of bare peat on the summit ridge badly eroded after the alpine plants had been crushed to death. In an ecological sense the three are disaster areas.

We started our efforts with a simple transplant experiment. Earlier we had noted that alpine bent grass, *Agrostis borealis*, one of the ten species of alpine grasses (all of which are relatively rare in the region) was flourishing nicely in one patch on another lofty summit, Gothics. From that healthy stand we lifted eight small clumps, roots, soil, and all, and transplanted them to one of our three study areas on Mt. Dix. With a sufficient dose of fertilizer, we hoped they would establish themselves and perhaps in time spread over the bare peat, stopping further erosion. To our disappointment we found only two clumps surviving the following year. As we had feared, the bare peat had been so leached of its few nutrients since becoming exposed to the weather some years back that it acted like a vacuum sucking up the fertilizer, in a sense, leaving little for the plants.

Meanwhile, in the other two locations where all plants had been killed out, we put in test plots trying to establish in each a

sod of new grass. Our purpose here was simply to see if we could get some other types of grass, commercially available, to grow during the summer. If so, then we would pick out certain northern species selected specifically to withstand year-long the severe environments prevailing on Adirondack summits. The tests in this case involved each time: a square yard of bare ground heavily fertilized so as to provide a favorable spot for any native plants to spread in; a second square yard planted to grass seed but without fertilizer added; and a third square yard treated with both fertilizer and grass.

Our first summer we didn't get the plots put in until mid-summer. The following spring we found no results whatsoever in the fertilizer-alone or grass-alone plots, though the grass had started in the grass-plus-fertilizer plot before September frosts had forced it dormant. The second summer we tried again, in late May; this time we also sprinkled over all plots half an inch of the black, amorphous muck that had been washed out of the peat years ago, but remained trapped in a nearby depression. That fall we were greatly excited to discover that the fertilizer-plus-grass plots were 90 percent successful, that each had a strong, vigorous sod of grass, much in contrast to the germinated but now dead grass on the unfertilized plots nearby. Now we knew we were on the right track both as to the fundamental ecological cause at the bottom of the environmental problem and to an expedient way of stabilizing the eroding surfaces. Our next task would be a mass treatment of the three bare areas, each of which covered about 200 square feet.

The following summer a party of four of us from the College of Forestry packed in 50 pounds of fertilizer and 10 pounds of grass seed to Mt. Dix. We treated the three main erosion areas uniformly with seed and fertilizer, and lightly broadcast the remaining natural mucky deposits over the peat. Our efforts were partially undermined unfortunately by a severe thunderstorm the night of the treatment, but even so we had 70-80 percent grass cover in September, better than we had expected. The first sight of that beautiful, vigorous, patch of lawn was to us a satisfying experience.

This past summer we expanded our efforts by bringing into the study Dr. Norman Richards, a fertilizer specialist in our Silviculture Department at the College. Under his direction we re-treated the plots using different combination of grass seeds and specialized fertilizers kindly formulated for us at no charge by Agway Inc., who have been supporting similar efforts in the Pacific Northwest. At the conclusion of the summer season 1970 we will evaluate our results to date. Hopefully in 1971 we will put in some final test plots on another untreated erosion area to verify our conclusions from the five-year study.

Our ultimate aim in this study is to prepare and distribute an erosion control guide for resource managers suggesting means for restoring eroded high-mountain trails and degraded summit areas, thereby giving the foresters in the field the tools and techniques to control the complicating disturbances brought about by recreationists in the already fragile environment we know as the Adirondack High Country.

THE RESPONSE

The response to the CONSERVATIONIST article was startling. Apparently we hit a sensitive spot in the public conscience, in part no doubt due to the universal concern for environmental issues, but also, we think, due to a special awareness among forest users themselves of what their increasing numbers are doing to the landscape. *They* are worried about what is happening. *They* realize that they themselves—individually and collectively—are at the root of the problem.

Meanwhile, as our work has progressed, Dr. Leonard and I have been talking about the problem to all sorts of interested groups across the State: college outing clubs, Boy Scout troops, hiking clubs, local chapters of national organizations, and lay groups of various persuasions. In every case, several members of the audience have expressed readiness to help in the work, some enthusiastically so. The numbers of volunteers prepared to spend a few days at labor

for us in the mountains is most gratifying and has assured us of a ready work force once we have formulated an action program, which this past winter we have done.

The biggest alarm to the growing environmental problem in the High Peaks has appeared, in part independent of our own preachings, in the two recreational groups most closely tied to the resource: the Adirondack Mountain Club, a 6,000-member organization of broad conservation-preservation interests who for years have assisted the State ranger force in their spring trail-clearance operations; and the Adirondack 46ers, a prestigous group of some 700 mountain climbers who have attained all 46 peaks over 4,000 feet elevation, which of course are the peaks most showing the ecological ravages of overuse.

The 46ers in particular have responded to the impact problem with soul-searching self-analysis. Their more active members have come to perceive that they in truth bear a major share of the responsibility, both because of their club's climbing activities and also because of the way they have oversold "peak collecting" as an exciting sport. Because their organizational conscience has been stirring separate from our proddings, they seemed ripe, so to speak, for Ray and me to convert to a new, invigorated rationale, a new mission of TRAILSMANSHIP, to justify their continued existence. Instead of disbanding as some had suggested, the leaders have persuaded the membership to help begin countering the damage by becoming examples of good trail stewards, of taking time off from their pleasure climbs to work constructively on trail improvements, thereby setting the standard for other forest recreationists.

To accomplish that end, we are now involving the 46ers as our working force in an action program to apply the lessons we have gained from our rehabilitation efforts in the High Peaks. This spring, assisted by personnel from the Department of Environmental Conservation, we are conducting a Trailsmanship Workshop for the 46ers to train a cadre of "trail medics," a pilot group of volunteers, to work with us in our continuing research program and with the ranger force of the Department in their regular trail maintenance and management activities.

In addition to the instructional program at the Workshop, we will organize the participants into small work parties that will assume responsibility (under supervision of the local trail ranger) for particular sections of the high-mountain trail system, including the summits. These squads will handle such minor problems as waterbars and similar environmental first aid when the need may rise, and also will be available occasionally to work with the Ranger should major rehabilitation be required. Similarly, a selected few members will work directly with our research party from the College, reseeding and treating a few eroding summits or scenic overlooks and otherwise assisting in our continuing studies of the basic ecological situation.

In September, at the annual 46er fall outing, the work parties will assemble for a review of our summer accomplishments and, more important perhaps, for a group evaluation of the basic idea of direct involvement of recreationists in vegetational restoration. We have every reason to believe that we will be successful in this pilot project, and in 1972 will be able to mobilize an even larger force to assist the local resource managers in their trail programs.

The simple moral of our story, we believe, is the new dimension to facility rehabilitation: involvement of selected recreationists themselves in a continuing program of vegetation restoration. There always will be an administrative lag in responding to ecological consequences created by recreation overuse, because of the lead time needed to gear up fiscally. Budgets may be anticipated in advance by the men in the field, for sure, but adequate funding typically materializes *after* the crisis, which may be too late. In the interim, while we await adequate staffing of the trail maintenance force, we *can* turn to the recreationists themselves to assist us to a significant extent as trail medics. The central theme to our story, the one contribution we feel we are making to the question of facility rehabilitation, is the new dimension of involvement of participating recreationists in vegetational restoration.

CARRYING CAPACITY: MAINTAINING OUTDOOR RECREATION QUALITY

by DAVID W. LIME and GEORGE H. STANKEY, *USDA Forest Service, respectively Geographer, North Central Forest Experiment Station, St. Paul, Minn; and Geographer, Intermountain Forest and Range Experiment Station, Missoula, Mont.*

ABSTRACT. A discussion of (1) what is meant by the concept of recreational carrying capacity; (2) what is known about capacities in terms of both how resources and experience of visitors are affected by recreational use; and (3) what alternative procedures the administrator can use to manage both resources and visitors for capacity.

RECREATION resource administrators, planners, researchers, and citizen groups are continually groping for strategies that will tell them how to manage the growing numbers of Americans participating in outdoor recreation activities. We at this symposium are keenly aware of the attractions of outdoor recreation, the rapidly growing needs for recreational services, climbing use figures, hazards to the resource resulting from intensive visitor use, and other barometers of a "crisis in the making."

These topics frequently lead to such questions as What is the appropriate level of use for any given recreation area? What steps can management take to increase an area's capacity without sacrificing quality? At what point must responsible administrators say, "That's enough; we're full; no more can come in"?

THE CARRYING CAPACITY CONCEPT

Few topics in recreation management are discussed as widely or as loudly as carrying capacity. The term is a perfect example of conventional wisdom: everyone talks about managing our recreation resources within their carrying capacity; but when you get to specifics—how many, what kinds, when, for whom, etc.—the discussion bogs down.

We might start with a statement of what carrying capacity *is not.* There seems to be real value in this approach because the term is often used in a misleading fashion. For example, many *space standards* have been popularized, such as those reviewed in *October Recreation Space Standards (Department of the Interior 1967).* Basically, these standards define the maximum number of use-units (people, vehicles, etc.) that can utilize the available recreational space at

one time for some activity while providing a "satisfactory" experience for the user.

For the most part, there is little evidence to suggest how the "satisfactory experience" factor was arrived at and used in determining various space standards. Also, these space standards have generally failed to incorporate the level of use the physical environment can tolerate over a given time period before serious damage results. Most space standards have developed from intuitive judgments and trial-and-error experiences rather than from quantitative evidence from controlled research.

Recreational carrying capacity is not a simple, single, absolute value. There is no fixed figure we can point to for a particular recreation area and say "This is the carrying capacity." The recreation manager is faced with a complex set of conditions. He must consider a wide range of activities, many of which are in conflict with one another. He must also provide for many different kinds of users; old, young, active, passive, etc. And he must provide opportunities for a wide range of values, many of which are incompatible with one another.

What then *is* recreational carrying capacity? We define it under the assumption that the principal goal of recreation management is to maximize used satisfaction consistent with certain administrative, budgetary, and resource constraints. The recreational carrying capacity is the character of use that can be supported over a specified time by an area developed at a certain level without causing excessive damage to either the physical environment or the experience for the visitor. Thus capacity is a multidimensional and dynamic concept capable of manipulation by the manager consistent with administrative, budgetary, and resource constraints.

There are three basic components of carrying capacity: (1) management objectives, (2) visitor attitudes, and (3) recreational impact on physical resources. These are not independent unique considerations, of course, but are closely interwoven.

Management Objectives

Capacity can be judged only in light of the particular management objectives for a given area. These objectives must define what type of recreational opportunity or opportunities the area is going to provide. For example, will the goal of the area be to provide camping in a near-natural setting with a low level of development, or will the emphasis be on high-density use with well-developed facilities for both comfort and activities, or what? A person interested in a camping experience in a near-natural setting with few others nearby will not enjoy camping in a state park with many other people camped close by. But this is not evidence that the area is being used beyond capacity. Rather, this individual's desires are inconsistent with the management objectives for this particular area.

At some point it may become evident that management objectives need to be re-evaluated, perhaps changed. With new objectives, management practices may be substantially altered and to the extent they are consistent with the new objectives the manager is on safe ground. Without definite objectives however, trying to manage any location for its carrying capacity will be an exercise in futility.

The goal of maximizing user satisfaction for a given geographic area such as the New England States can be met only if we provide a spectrum of opportunities that meets the diverse and often conflicting tastes of the public.

Burch *(1964)* has noted that although there is a wide range of recreational tastes, certain kinds of activities tend to be associated with one another. These "activity aggregates" place certain demands on the resource and relate in certain predictable ways to other users. Thus, regionwide planning may be needed to meet the diversity of recreational tastes. However, "no one recreation supplier need feel obliged to meet all demands. Each public agency could aim clearly at a part of the demand, and refer people who want something more, less, or different to a more appropriate area" *(Lucas 1963)*.

Today, developed camping facilities occupy only about 1/20 percent of National Forest land. Although much of the land is unsuited for recreational developments, the notion that we have used up the capacity of our National Forests to provide for recreational demands is simply invalid. We do

face a problem in establishing the appropriate mix of the many kinds of recreational opportunities we might develop, and it is here that an understanding of what the recreationist seeks becomes invaluable to management decision-making. By making sure that a full range of opportunities exists (regardless of the agency or organization that provides them), we will then be in a position to match visitor needs with opportunities rather than trying to develop recreation areas for the mythical "average user" *(Shafer 1969)*.

Visitor Attitudes

"Perception" refers to the process whereby an individual receives information from the social and physical environments in which he operates, interprets it in light of his experience and attitudes, and then reacts. We know that all recreationists do not perceive the environment in the same way; what is a quality recreational experience to one may be entirely undesirable to another.

But perhaps of more importance is that what the recreationist perceives as acceptable or desirable may be quite different from what the manager perceives *(Stone and Taves 1958; Lucas 1964; Hendee and Harris 1970)*. In a study of National Forest campgrounds, Lucas *(1970)* found that visitors ranked recreational site quality much differently than Forest Service administrators did. Sites ranked by managers as only "fair" were almost all ranked higher by users. Consequently, what the manager judges to be a pleasing recreational environment may be entirely different from what the recreationist seeks.

Defining recreation standards and objectives requires the consideration of *values*. Because values are subjective, to evaluate them is particularly frustrating for managers. Whose values are to count most—the managing agency's or the public's? If public values are to be relied upon, which "public"?—there are so many of them!

The answer to this dilemma is found in how visitor objectives relate to management objectives. As we suggested earlier, the needs and motivations of recreationists vary considerably; so do recreational areas. We must strive to match the two; if we fail to do so, individual recreation areas will tend to become homogeneous, lacking the variability and diversity needed in a recreational complex. We cannot please everyone everywhere. "It seems misleading to give equal weight to evaluations by people who are seeking a different type of area or experience. By analogy, a Chinese restaurant would do well to ignore the opinion about the food expressed by someone who ate there by mistake while seeking an Italian restaurant" *(Lucas 1970)*.

Although management cannot rely solely on public opinion in formulating decisions, visitor attitudes are valuable in formulating decisions. They help define the spectrum of opportunities needed, and the mix of these opportunities; and they shed light on how visitors might respond to specific management actions. Knowing who may oppose a given management action and taking measures to explain why their preferences cannot be met may be as important as deciding for whom the area will be managed *(Lime 1971a)*. Surveys of public attitudes can give objective, unbiased feedback not otherwise available to the manager on a variety of questions.

Impact on Physical Resources

How much wear and tear of the resources should the manager permit before he says, "that's enough"? This recreational impact on physical resources is the third component of carrying capacity.

Any use of an ecosystem results in some change; Frissel and Duncan *(1965)* found that only light use of camping sites in the Boundary Waters Canoe Area (BWCA) resulted in a loss of over 80 percent of the ground cover at the campsite. Even in locations where the management objective is to maintain a natural or near-natural setting, we immediately compromise total achievement of that goal simply by allowing use of the location!

Some might argue that the capacity of an area is the amount of use that area can support without serious damage to the resource. But what is "serious" damage? A portion of the damaged site will recover after a brief rest if use is kept low enough to allow the site to recuperate. On the other

hand, certain techniques can be used by the manager to "harden" the site: he can irrigate, fertilize, rotate use, or pave, thereby making the site more resistant to change. But the action the manager takes is based on how change relates to management objectives rather than directly on change itself.

In an activity-oriented, high-density-use campground, the manager would be free to use a variety of techniques to offset problems of resource damage; for example, paving or planting hardy species. However, in a campground where the objective is to provide a camping opportunity in a fairly natural setting, the amount of resource change permissible would be comparatively small. To maintain the natural setting, the manager might have to resort to restrictions on use (numbers of people, kind of use) rather than on techniques that "harden" the site.

What the manager needs to know about recreational impacts upon the resource is (1) the character of change that will occur under specific levels and types of use, and (2) how the predicted change in the physical environment relates to the management objectives for the area. Decisions about how much change is to be accepted will be more viable and defensible if we know more about how people perceive and respond to changes in the physical environment. The final decision will rest with the manager, but he can greatly narrow the range of uncertainty in decision-making through active dialogue with the interested public as well as with planners, engineers, academicians, and researchers.

EFFECTS OF RECREATIONAL USE ON PHYSICAL RESOURCES AND VISITOR ENJOYMENT

As we noted earlier, the management objective set for a recreation area is the controlling factor in determining carrying capacity. In setting management objectives, the physical resources of the area and the attitudes of users must be considered. Both of these variables are affected by increasing loads of recreationists and may together or by themselves establish constraints on the amount of use the area may sustain.

Impact on Physical Resources

We have considerable documentation of the effects of recreational use on soil, vegetation, and other physical components of the resource base. Damage to ground cover occurs not only because of direct bruising and crushing of vegetation, but also because of soil compaction due to trampling by visitors. Root growth is impaired and tree stability is affected. Vegetation sensitive to use may be replaced by more resistant species *(LaPage 1967)*. Marked changes occur in hydrologic conditions, such as a reduction in available soil moisture. Substantial amounts of protective plant litter may also be lost, further increasing the chances of soil erosion.

Water is the focus of considerable recreation use. As a consequence, problems of water pollution will represent a growing concern for the recreation manager. Oil and gas pollution from outboard motors is an especially serious problem. Between 10 and 33 percent of outboard fuel is discharged into the cooling-water exhaust stream as unburned wastes—and it may be as high as 40 percent *(Muratori 1968)*. Think of the impact of those 7 million outboard craft that were using our inland waters in 1966, over 5 years ago!

Related problems stem from the discharge of human wastes into water bodies, creating not only potential health hazards, but also touching off such problems as algal blooms *(Barton 1969)*.

Wildlife plays an important role—sometimes a primary one, sometimes as only an incidental source of enjoyment—in many recreational activities. Regardless of how wildlife meshes into the recreationist's objectives, however, its abundance, behavior, and survival is often influenced by recreational activity.

Impact on Visitor Enjoyment

Only a few studies have been made on how change in site quality affects a visitor's enjoyment or how the amount of recreational use affects the quality of a visitor's experience.

The Outdoor Recreation Resources Review Commission *(1962)* found that visitors to a wide range of recreational areas were

satisfied with the numbers of other people they encountered. In fact, the study indicated that one out of five persons felt that meeting more people would have been all right. On the other hand, nearly one out of four National Forest visitors in the study felt that use levels were excessive.

One method of reducing the feeling of crowding is to provide a certain minimum spacing between campsites. In a study of New England state parks, Shafer and Burke *(1965)* found about one out of three persons desired a spacing of 250 to 400 feet (the sites were only 50 to 100 feet apart). In a study of National Forest campers in Minnesota, Lime *(1971b)* found that nearly all parties preferred to be well separated and screened from their neighbors. On the other hand, many recreationists prefer and even seek areas that afford opportunities to be close to others *(Burch and Wenger 1967)*.

The most substantive work on crowding has been conducted in wilderness. In the Boundary Waters Canoe Area, Lucas *(1964)* found that canoeists objected to encountering others more than motorboaters and motorcanoeists did. Canoeists defined crowding not only in terms of numbers of people, but also in types of use (motorboats). On lakes where total season use was less than 300 groups of canoeists, canoeists felt that crowding was no problem. Where motorboats were found, however, canoeists felt crowded sooner. In another study in the BWCA as well as in three western wildernesses, Stankey *(1971)* found that tolerance to crowding was a function not only of the level and type of use encountered, but also of where and when the encounters took place and the destructive behavior of visitors.

Thus unrestricted recreational use will eventually lead to soil compaction, alteration in plant species composition, increased erosion, and dissatisfaction among visitors—regardless of whether we are talking about a state park campground or a wilderness area. Since these areas have different objectives, the decisions a manager might make and the alternatives he may wish to consider are different.

TECHNIQUES FOR MANAGING THE PHYSICAL RESOURCES AND VISITORS FOR CARRYING CAPACITY

All too often we view carrying capacity in an "either/or" context: either we allow use to continue unchecked or we drastically restrict numbers. Although both of these actions are alternatives that the manager may at some time decide to adopt, there is a wide variety of alternatives and techniques available to management that will help insure the goal of maximizing user satisfaction while protecting desirable resource characteristics before it becomes necessary to actually restrict numbers. We must re-emphasize that the option or combinations of options a manager may consider for any area depends primarily on the management objectives prescribed for that area. The specific goals of the area limit the character of options the manager can use.

The manager should try to accomplish the following—much of it based on Wagar's *(1964)* discussion of managing for carrying capacity—depending on the area and its management objectives: reduce conflicts among competitive uses; reduce the destructiveness of people; increase the durability of the physical resource; and provide increased opportunities for visitor enjoyment. These goals can be achieved by three overlapping courses of action: (1) site management; (2) modification of visitor behavior through direct regulation; and (3) modification of visitor behavior by means of indirect and more subtle measures.

Site Management

Imaginative site design, landscaping, and engineering can effectively increase the carrying capacity of some sites by channeling the movements of visitors, thereby limiting the area they damage, providing surfaces that withstand intensive use, and providing access to areas that are otherwise unused or very lightly used.

The movements of recreationists often can be guided by the design and arrangement of facilities and barriers. Posts, logs, rocks, and, in more critical places, fences or guard rails, can be used to keep vehicles in parking spots and out of campsite and pic-

nic areas *(Magill 1970)*. Paths, elevated walkways, and bridges can similarly channel movement.

Care should be exercised in selecting the route of paths. Routes that are picked simply because they happen to be the cheapest or easiest place to put a path probably will do little to enhance visitor satisfaction. On the other hand, letting visitors choose their own routes around the campground and then hardening these paths could result in an unnecessarily large amount of ground being paved. We need more information about the factors that influence pedestrian traffic flow.

Several techniques can be used to increase the durability of the biotic community. Sites that have been damaged by overuse will eventually recover, given enough time. The demand for recreational space is such, however, that most managers cannot afford to have a substantial proportion of the areas under their administration tied up in natural restoration. As a consequence, managers will generally need to assist natural recovery processes.

Irrigation, fertilization, and reseeding can greatly accelerate the recovery of sites. Herrington and Beardsley *(1970)* found that an application of water, fertilizer, and seed would revegetate 70 percent of the cover at campgrounds in central Idaho in only 3 years, a percentage unattainable through the application of seed alone.

Where recreation use is heavy, managers may wish to convert the natural vegetative cover to more hardy species. Ripley *(1962)* has listed a number of conifers and hardwoods that demonstrate considerable resiliency in the face of heavy recreation use. Thinning the overstory also can increase the resistance of trees and understory vegetation to abuse *(Wagar 1965)*. Judicious thinning could be done to protect soil-moisture values while not appreciably reducing the amount of shading for visitors.

Recreational use can be redistributed and capacity can be increased by providing access to previously underused areas. This means not only additional roads and trails, but also construction of facilities. The installation of trails, lights, elevators, etc. at some of the Nation's more spectacular caverns (Carlsbad, for example) has unquestionably disturbed the cave's ecosystems. Few of us, however, would enjoy these areas had they not been altered to increase their carrying capacity. It is important to recognize that providing access not only effectively increases capacity; it can also quickly alter the type of recreational opportunity offered.

Regulating Visitor Behavior

Through direct regulation of where visitors may go, how long they may stay, and when they may enter the area, management can attain a desired intensity of use for a particular site. Regulatory procedures include zoning, rotating use, limits on party size, and reservations. Implicit in these techniques is a trade-off between the loss in the recreationist's freedom of choice and the gain in ability of the site to more nearly meet the visitors' needs and objectives.

More visitors competing for the same amount of recreational space will frequently mean that they interfere with each other's activities. For example, water-skiing and fishing in the same area just do not go together. Mechanized trail travel (snowmobiles, trail bikes, ATV's) is largely incompatible with foot travel. Allowing high-intensity bike use in the immediate vicinity of an important nesting area for eagles could create a serious conflict.

Separating or zoning conflicting uses accentuates the need for careful and deliberate planning, but the benefits to be gained will generally outweigh the costs. Perhaps most important, zoning can assure the perpetuation of a range of recreational opportunities in an area. It assures the user's right to a free choice among alternative forms of recreation. In winter setting aside separate trails for snowmobilers and snowshoers or cross-country skiers seems especially warranted if management wants to maximize enjoyment for both groups. In the Boundary Waters Canoe Area, outboard motors and snowmobiles are banned from about one-half of the total area to reserve this part of the region for more primitive forms of recreation and travel.

In Alaska, the State Fish and Game Association has instituted a zoning plan in

controlled-use hunting areas that will restrict use to primitive travel (foot, dog team, or horse) in some areas while only foot travel would be permitted in other areas. Also planned is time zoning where only so many people are permitted in a certain area at a time.

Rotating use among available sites and relying on the inherent resiliency of the resource to accommodate use is another means for reducing permanent damage caused by concentrated use. Temporary recuperation periods after watering, seeding, and fertilizing probably would be most desirable. Developed recreation areas could be designed in such a way that sites are rested 1 year in 3. In camping areas and picnic grounds, for example, this could be accomplished by constructing three distinct areas with separate access roads and closing off a different one each year. This would require that areas be overdeveloped by at least one-third; but, coupled with a continuing maintenance program, the results might be very rewarding.

Limiting the size of parties is an important management tool for alleviating damage to the resource. Large groups are excessively destructive of resources not only because of the large amount of space they require but also because of the intensive nature of the use. For example, ten separate parties of three horses each who use an area over a 2-month period undoubtedly will have a less detrimental impact on the trail and campsites than if all 30 horses traveled as a single group.

The noise and congestion often associated with large groups is another reason to limit party size. Although we as yet do not know how visitors react to large groups in developed recreation areas, Stankey's *(1971)* research in wilderness showed that large parties are strongly disliked by others. Even though large groups constitute only a small proportion of total use for most recreation activities, they may well cause a disproportionate loss of enjoyment.

Requiring recreationists to obtain reservations is one way to control both the level and character of use at any given area. Complete switchover to a reservation system might create some formidable administrative problems as well as negative reactions on the part of some of the recreating public. A limited reservation system may be very useful, however.

For example, the State of Oregon has put some of its large state parks on a reservation system for the summer use period. A central clearinghouse with a toll-free telephone number maintains information regarding available camping locations. Reservations are made by phone or mail with each individual park. Although difficulties have been encountered with the program (people not showing up for their reservations, for example), the system seems well accepted. One result of the reservation program has been a shift in the makeup of use at different camps; Oregon residents tend to use the reservation parks more, while nonresidents fill the nonreservation camps.

Modifying Visitor Behavior

By understanding the factors recreationists consider in making decisions about where to go, and what to do, managers can modify visitor behavior in more subtle and less obtrusive ways. By doing so, the manager does not interfere directly with the visitor's freedom of choice, yet he influences the user to make choices that produce desired changes. Visitor behavior can be modified by (1) communication and interpretation services, and by (2) fees or other eligibility requirements. Techniques to maintain the site also fall in this category because the way in which facilities are managed can influence a user's decision on whether to visit the site or not and how long to stay.

It is our opinion that the dissemination of information to the public is one of the most fruitful tools administrators have available to modify visitor behavior. By increasing contact with the public (both visitors and potential visitors) managers can probably solve many current problems and help avoid others.

Communication and interpretative services for recreationists are many and varied. Organized services with personal contact

include illustrated talks, movies, slides, nature walks, tours, and campfire programs. Other services include self-guiding trails and roads, museums, brochures, maps, and guidebooks. Communication between one public agency and recreationists could be increased by greater dissemination of information through other public agencies, local businessmen and chambers of commerce, newspapers and magazines, and radio and television.

Another approach is to build some visitor information centers in metropolitan areas so users can more efficiently plan trips in advance. This also would provide an opportunity to educate them about appropriate behavior, rules, etc. Because many users find recreation areas by just driving around, it is essential to have an adequate number of effectively placed roadside information signs. A study in Utah showed recreational use of an area could be changed substantially by signing *(Brown and Hunt 1969)*. Finally, there undoubtedly are countless imaginative communication techniques being utilized in other fields of public relations that can be applied directly or modified for use in recreation management.

What are the byproducts both for managers and recreationists of an effective communication or interpretation program? First, increasing our contact with visitors can help them find out what the range of recreation opportunities and attractions is in a given geographic area. They can then route themselves to those areas that match their interests. Recreational experiences may also be enhanced if visitors can be taught an understanding of basic concepts of ecology and other outdoor values. This in turn should increase their awareness of some of the more subtle attributes of an area (geology, wildlife, vegetation, archeology, and anthropology). By deepening their sense of appreciation and awareness for the natural environment, more recreationists could take better advantage of an area's recreation potential.

Second, we hope that increasing the flow of educational information to the public will result in a reduction in the destructive behavior of some persons. We assume here that much of their destructive behavior is simply the result of not knowing what is right, rather than overt maliciousness.

Third, better communication with the public gives the manager an opportunity to explain to those visitors who object or are opposed to certain management actions why their preferences cannot be met. Not only should management try to better understand the needs of their clientele, but they have an obligation to help the public understand the needs and goals of recreation management. Ultimately, this two-way process can do much to win public acceptance and support of many management procedures.

Finally, increasing the flow of information that the recreationists use in making decisions is another way to change patterns of use. More uniform and efficient use among sites should be possible. For example, people seeking solitude should be informed where use is lightest. This would both make use of sites more uniform and would also help people to maximize their enjoyment. Snowshoers and skiers would probably appreciate very much knowing on which trails they could least expect to encounter snowmobiles.

Various aspects of visitor behavior—especially use patterns—can also be modified in both space and time by the use of entrance fees, particularly differential fees. Where there is wide variation in the intensity of use between similar recreation sites (campgrounds, trails, etc.) in a given area, differential fees could produce a more even distribution of use. In much the same way that airlines and hotels use off-season rates to attract tourists, both public and private recreation suppliers could employ differential charges to shift some use to off-peak times *(LaPage 1968)*. Managers of camping areas, for example, could lower or perhaps eliminate entrance fees altogether when use is traditionally low—on weekdays, during Indian summer, and so on. Some managers will be in a position to promote winter camping and extend special rates in an effort to spread use to other seasons. For those recreationists seeking an escape from the normally crowded summer campgrounds, these opportunities could be especially appealing.

Requiring recreationists to demonstrate a certain minimum level of knowledge or skill before they are eligible to participate in an activity or enter an area is another means of maintaining recreational quality where there is limited capacity and high demand. The "hunter safety" program is similar to what we have in mind; young people are required to show a certain level of proficiency in firearm safety and game-management principles before receiving a hunting license. Because of potential crowding in wilderness, "entrance exams" may some day be desirable to maintain the quality of such areas *(Hardin 1969)*. While these actions of management are regulatory to a point, they do not interfere directly with the recreationists' freedom of choice. Once he has demonstrated his ability, a person is essentially free to do as he pleases, consistent with certain rules of safety.

Eligibility requirements could also be established differentially to shift use from one place to another and from one time period to another. Inexperienced canoeists, for example, might be excluded from certain streams at certain times until they reach an acceptable level of proficiency. Snow skiing is another activity where an individual could be required to demonstrate a minimum level of skill before he could use certain slopes.

We hasten to add that law enforcement also has its place in managing for capacity. Regardless of what the land manager does to protect the resource and enhance visitor enjoyment, some people simply will not get the message. To protect the site as well as the rights of the careful visitor, the responsible administrator may at times have to rely upon legal sanctions.

SUMMARY AND CONCLUSIONS

Our efforts to explore the topic of carrying capacity have left us with five conclusions.

1. There are many possible carrying capacities for a given recreation area. These capacities can be defined only in light of the objectives for the area in question. These management objectives must consider: (1) the type of recreational opportunities the area itself is going to provide, and (2) the recreational opportunities other recreation suppliers in the immediate area provide. As a result, managing agencies should work closely with each other in regional planning so their individual areas function as part of a whole.

Providing a wide range of opportunities to choose from in a region will help visitors maximize their enjoyment. Use patterns should more closely parallel the goals of management, and the efficiency of management should be more nearly optimized.

2. Determining carrying capacity ultimately requires the consideration of human values. Because of the subjectivity of these values, it is essential that managers carry on an active dialogue with a variety of publics. In this way management objectives and capacity guidelines will be more viable and defensible against public criticism.

3. The resistance of an area's resources to use is an important constraint on carrying capacity. Yet, knowing how the resource is affected by various levels and types of use does not by itself tell the manager what is an acceptable amount of change to permit. There are many possible standards of acceptable change that the manager could employ. It is important to remember that the objectives for the area are the controlling factor for these standards. Managers must consider the opinions and concepts of a variety of publics before they act. Although administrators cannot manage by public opinion alone, these opinions can help the manager narrow the range of uncertainty in the decisions he makes.

4. There has been considerable research about the effects of recreational use on resources and recreationists. Our knowledge of the adverse effects of use on soil and vegetation resources is relatively good; knowledge about the effects on other resources—especially water and wildlife—is much less definitive.

Our knowledge of how various levels of use, types of use, and site design affect the experiences of users is still less understood. We have learned, however, that recreationists who appear superficially similar do not

have identical needs and do not perceive the recreation environment in the same manner. Nor do managers perceive the recreation environment in the same way as recreationists. Because of differences in people's tastes, it is essential that leisure behavior be thoroughly understood.

5. Managing an area for its carrying capacity can be accomplished in many ways. Numerous procedures are available to the manager before it is necessary to ration total numbers of recreationists. The aim of these techniques should be to: reduce conflicts among competing uses; reduce destructive behavior of people; increase the durability of sites; and provide increased opportunities for visitor enjoyment.

Procedures for postponing the rationing of use include: (1) site management—barriers, paths and trails, roads, artificial surfaces, irrigation, fertilization, and hardy species of vegetation; (2) regulating visitor behavior—zoning, rotating use, party size limitations, and reservations; and (3) modifying visitor behavior—communication and interpretation services, fees (especially differential fees), and other eligibility requirements. The *best* technique or combination of techniques to use depends primarily on the particular recreational opportunity the area is meant to provide.

Regulations, direct or indirect, are useful tools for the recreation manager. But they must be applied thoughtfully, with careful reasoning underlying their implementation. A campground filled with signs saying what a person *cannot* do will not go very far toward meeting the underlying objective of recreation management—maximizing user satisfaction. Regulations should be viewed as means to an end rather than as an end in themselves. All of us, administrators, managers, researchers, and the recreating public, need to remember that. To the extent that a regulation helps meet management objectives, it is useful. Beyond that, it is simply an encumbrance to all parties concerned. More important, indefensible regulations will make it more difficult to institute needed rules at some later time.

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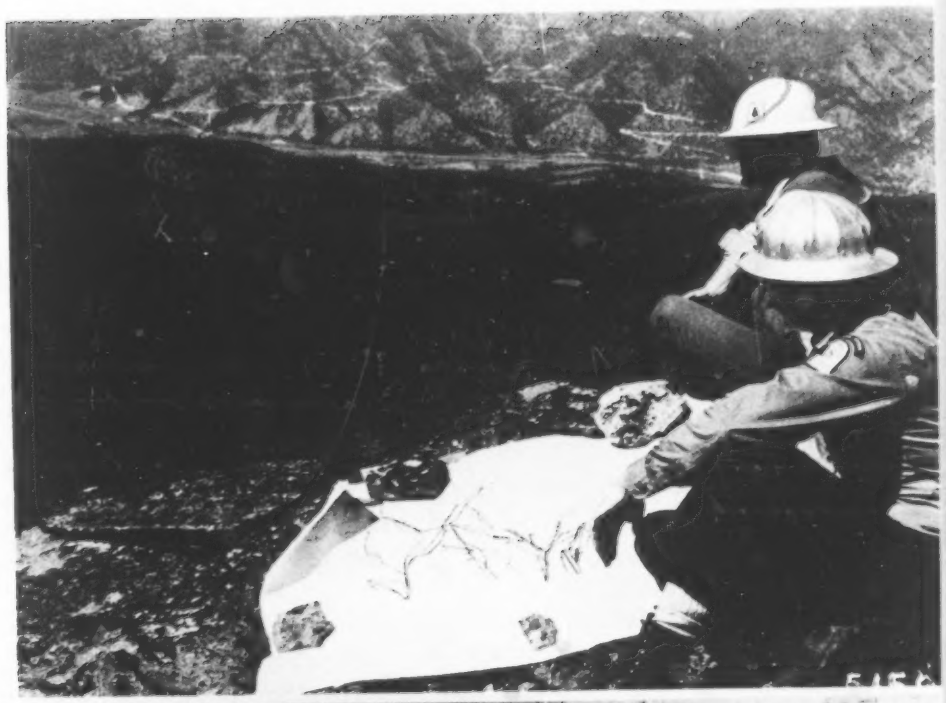
A Look at the Research Task Ahead



CULTURAL "FOGWEED" AND OUTDOOR RECREATION RESEARCH

by WILBUR F. LaPAGE, *Recreation Specialist, Durham Research Laboratory, Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Durham, N. H.*

ABSTRACT. A critical look at outdoor recreation research and some underlying premises. The author focuses on the concept of culture as communication and how it influences our perception of problems and our search for solutions. Both outdoor recreation and science are viewed as subcultures that have their own bodies of mythology, making recreation problems more difficult to define and to resolve.

EDWARD deBONO, physician and author of several books on the subject of how people think, argues that ". . . there are fields in which progress has been held up for ages because of the dominance of obstructive myth-like concepts . . . A convenient term for such concepts is 'fogweed,' because they grow readily on fertile soil and quickly obscure . . . furthermore, enriching the soil with more information only strengthens the fogweed" *(deBono 1969).*

A more accurate description of the state of outdoor recreation understanding, and the effect of the past decade's research, would be difficult to imagine!

Outdoor recreation is the classic case of a field choked with "fogweed." Dr. deBono's "fogweed" is, I suspect, simply the generic name for a great many species of habit-forming and hallucinogenic plants. Excessive exposure to the weedy field of outdoor recreation results in a variety of commonly recognized ailments such as a blind insistence upon treating correlates as causes: "More income, more leisure, and more travel, must always mean greater individual participation in outdoor recreation."

Another sure symptom of fogweed overexposure is the pleasant fantasy that there are no causes and no effects. Everything is tautology: "recreation produces good citizens" and, of course, "good citizens recreate"; "people don't pay much to use a public park"; and "people won't pay much for their outdoor recreation." And almost all fogweed victims eventually suffer severe delusions, such as the idea that "outdoor recreation demands are generated by a mass return-to-nature motive."

And so the myths continue, despite their inability to provide us with any useful social understanding of outdoor recreation. They flourish in the face of authoritative reports such as Herbert Gans' statement that ". . . I do not believe that outdoor recreation is more environmentally favorable in terms of mental health values than other environments, or that there are significant relations between outdoor recreation, physical fitness, and mental health" *(Gans 1962).*

We seldom question any of our most basic outdoor recreation premises until someone like Philip Foss reminds us that there is ". . . no apparent reason in logic or equity why a private landowner should be asked to pay the cost of providing hunting

opportunities for the public" *(Foss 1966)*. And, if you doubt that there are real costs involved, just look at the bill for vandalism that occurs every hunting season! *(Bennett 1969)*.

Perhaps our cultural beliefs do not have to stand the tests of logic and equity, but simply those of time and repetition! Because public attitudes toward outdoor recreation are so profoundly shaped by these and similar subjective, and often emotional cultural "facts," we in recreation research and recreation resource management should benefit by a better understanding of how culture pervades our perceptions of leisure, outdoor recreation, and science.

"CULTURE IS COMMUNICATION"

Although there are more than 160 different definitions of culture *(Berelson and Steiner 1964)*, there is a common thread of agreement that culture is "learned and shared behavior." If culture is learned, then culture must also be taught (even if not consciously). It follows, then, that "culture is communication" *(Hall 1970)*.

The utility of this concept becomes increasingly obvious as we begin to identify the many nonverbal forms of communication that are used by people having a shared culture, such as facial expressions, body language, seating arrangements, the professorial gown, the thickness of one's office rug, and many, many, more.

Anthropologist Edward Hall has identified 10 "Primary Message Systems" by which culture is learned, and 9 of these are not dependent upon a spoken or written language. For example, members of different cultures are likely to have different perceptions of territoriality, and therefore different reactions to feelings of crowding and different needs for privacy. A 200,000-acre wilderness may seem like an extravagance to some, while for others it is a cultural necessity.

Similarly, temporality, or time awareness, varies from culture to culture; as does bisexuality, expressed in different sex roles in other cultures. Our cyclical approach to time utilization and our beliefs about appropriate sex roles strongly influence how we perceive leisure and the uses we make of it.

There are even cultural differences in the ways in which people learn how to learn. Some cultures stress "doing" as a principle of learning, while others do not; and Western cultures are much more likely to stress logic than rote or memory. And once people have learned how to learn in a given way, it is extremely hard for them to learn in any other way *(Hall 1970)*.

We are, therefore, products of specific cultural and subcultural systems, even to the ways in which we think, the problems that we advance as being worthy of study, the methods by which we examine those problems, and the solutions that we propose. It should not really surprise us that middle-class researchers with middle-class concepts of leisure and resources consistently find that outdoor recreation is predominantly a middle-class activity! Could they have found otherwise? Both upper and lower classes have ample reasons to avoid designated outdoor recreation areas.

A classic example of this cultural blinding of thought processes is the true story of the skyscraper that was built with too few elevators. Elevator delays at the beginning and end of the day were causing problems of employee dissatisfaction and even resignations. Numerous solutions were proposed, such as installing more elevators, speeding them up, stopping them at alternate floors, and staggering working hours to reduce the load. But the solution finally selected was neither a technical one or a direct assault upon the problem. Mirrors were installed in the corridors around the elevators, and the office workers became so preoccupied with looking at themselves (and stealing a glance at others) that no one noticed the long wait for the elevators any more *(deBono 1969)*.

By a seemingly simple shift in problem definition, in this case from one of mechanical inadequacy to one of human impatience, a costly solution was avoided. Perhaps none of our problems in outdoor recreation can be so easily solved. But at least the example illustrates the desirability of trying to redefine the problems.

Some problems have been known to disappear upon redefinition. Perhaps that pervasive planner's dilemma of "how can we meet the outdoor recreational needs of

today's and tomorrow's generations?" is just a wisp of fogweed?

Redefining an accepted "problem" is, of course, easier said than done because "culture hides much more than it reveals, and strangely enough what it hides, it hides most effectively from its own participants *(Hall 1970)*. I suspect that cultural blinding becomes most pronounced through training in our professional subcultures, if we may judge from the impressive number of major advances that have come from outside their field of specialization *(Burnett 1966)*:

- Of three discoveries essential to modern surgery, none was discovered by a surgeon!
- Of four important railroad devices, none was invented by a railroad man!
- The motel, that most successful innovation in innkeeping, was not developed by traditional innkeepers!
- The great movie chains did not pioneer the drive-in movie!
- And paperback books were not the brainchild of the existing publishing houses!

Two of the major developments in outdoor recreation of the past decade also came from outside. Just a few short years ago nearly everyone equated camping with canvas and public parks. Today, there are more than 10,000 commercial campgrounds, more than 30 chains of franchised campgroupings, and over 300 manufacturers of trailers, motor homes, and other types of camping vehicles.

Changes such as these reveal one of culture's most interesting aspects. And that is, despite culture's automatic tendency to communicate a positive view of the status quo, our cultural beliefs are constantly changing in both evolutionary and revolutionary ways. Philip Kotler, in his book "Marketing Management," suggests that we are in the midst of change in some of our most important cultural values, such as a shift from self-reliance toward reliance upon government, from hard work as a good in itself toward the easy life, from religious convictions toward secular convictions, from husband-dominated homes toward wife dominated homes, from parent-centered homes toward child-centered homes, from independence toward security, from parental values toward peer-group values, from saving toward spending, from postponed gratification to immediate gratification, and from respect for the individual toward dislike of individual differences *(Kotler 1967)*.

THE EIGHTH PRIMARY MESSAGE SYSTEM

For many years, outdoor recreation proved to be a popular way of expressing such cultural values as thrift, hard work, and self-reliance. Today, we also see outdoor recreation reflecting the more contemporary values of conspicuous consumption, immediate gratification, peer-group acceptance, and the easy life. This suggests that outdoor recreation is, if not a battle ground, at least a focal point for cultural clashes.

Appropriately, in Hall's hierarchy of primary message systems, *recreation* falls between *learning*, No. 7, and *defense*, No. 9. A visit to any of today's crowded parks and recreation areas can readily provide a vivid experience in learning about other people's rights while defending your own.

As I read them, the tirades of one outdoor interest group against another are clearly ideological: back-pack campers versus recreational vehicles; trail scooters versus those who go into the woods to get away from noise and air pollution; rural-bred hunters versus urban-bred hunters; and snow vehicles against an assorted band of hunters, hikers, and cross-country skiers! Mass recreation, once firmly allied with conservation interests, is increasingly being cursed along with industrial polluters and other desecrators of the landscape.

Outdoor recreation is a means of expressing so wide a range of cultural values that the question of "how long it can go on being all things to all people?" underlies all of our research and planning efforts.

At any campground, we may interview people for whom camping provides a release from the competitiveness and status-consciousness of modern society, and others

who find in camping a new way to communicate dominance and superiority. Sharing any fishing hole we can find fishermen who are competing with nature by using light line, barbless hooks, and releasing their catch, alongside others who compete on the basis of the most fish brought home and, perhaps, given away. Our trails are increasingly peopled with machine users and machine avoiders, each challenging the other's territoriality.

These are the kinds of conflicts that really delimit society's demands for outdoor recreation. And yet we continue to find outdoor recreation analysts who persist in a simple-minded pursuit of the promise of more leisure, more income, more mobility, and more people—as though the outdoors has an endless capacity to absorb conflict.

More and more cracks are beginning to appear in some of the long-accepted foundations of outdoor recreation planning as the evidence mounts that the average American does not have all the leisure that he is supposed to have *(Linder 1969; Burck 1970)*, that his participation may actually be declining *(LaPage and Ragain 1970)*, and that his recreational forays into the wild rarely have anything to do with a return to nature.

The return to nature, or the "Arcadian Myth" as Peter Schmitt calls it, is probably the most influential of our outdoor beliefs *(Schmitt 1970)*. Simply stated, the "Arcadian Myth" is the belief that goodness and strength flows from the land and that rural living is vastly more suited to the human condition than the artificiality and complexity of urbanized areas. In one form or another, this belief has been the theme for countless books, the thesis of much serious (if inconclusive study, and the popular explanation for such social phenomena as urban crime and delinquency, urban decline, suburban growth, and outdoor recreation demand.

This same concept in words and in pictures sells a lot of outdoor equipment. Or does it? The buyer of the light-weight back-pack outfit and the buyer of the $20,000 motor home are equally likely to be expressing an extension of our pioneering subdue-the-wilderness ethic—which is something else entirely.

Since those who endorse a return-to-nature theory of recreation demand choose to ignore how the outdoors is used, and concentrate only on the fact that it is used, the concept is little more than a tautology. Values inferred from the behavior rather than measured independently are gratuitously used to explain that same behavior.

The net gain in understanding provided by a tautology is zero. In fact, it may even be less than zero if it should encourage less than adequate recreation management, risky investment of public and private funds, and a false sense of security that a seller's market exists!

The return-to-nature reflects a philosophy that behavior responds more to environmental pressures than to the individual's free will. Many outdoor recreation researchers may be revealing their own philosophies in their numerous multiple-regression analyses that use environmental data to explain the variation in park visitation rates and in individual recreation participation frequencies.

A more philosophically neutral cultural belief that also influences much outdoor recreation thought is the mistaken idea that leisure is the opposite of work. This leads to all sorts of unfortunate image-opposites as a result of the persistent Protestant work ethic which equates work and with good attributes, character building, dependability, honesty, and thrift. Of course, the more physically demanding the work, the stronger the implied attributes.

I recall reading, a few years ago, an observation in the READER'S DIGEST about a first-grade test. One item in the test showed two drawings—one of a man chopping wood, the other of a man reading a book. Students were asked to circle the picture that showed a man at work. One little girl circled the reader and was marked wrong. What the teacher failed to understand was that the child's father was a professor who read at work and chopped wood for relaxation.

Fortunately the work-leisure dichotomy is disappearing. At a 1964 recreation education conference in Syracuse, the keynote speaker stated emphatically that leisure is

not idleness; that it is not the opposite of work *(Tolley 1964)*. At a conference on Leisure in America at Philadelphia, in 1963, one of the conference summarizers expressed the group's consensus that "recreation is a field of life standing along with health, education, work, welfare, and religion in bringing 'human wholeness' to man" *(Charlesworth 1964)*.

A recent National Academy of Sciences conference report continued this same theme by introducing recreation as a "social institution" *(National Academy of Sciences 1969)*. However, the work-leisure dichotomy still clearly influences the ways in which Americans live, and it colors (with social acceptability) the recreational motivators that they report to researchers.

The Arcadian Myth and the Protestant Ethic are only two of our cultural beliefs that can influence research goals, research findings, and outdoor recreation planning. There are, of course, many more, including the myths of increasing leisure time, increasing per-capita participation in recreation, and the myths of perfect planning, perfect accounting, and perfect market knowledge *(LaPage 1970)*. And these, taken together, compel us to treat the future as our subservient colony, predicting its needs, acquiring land, and planning for its orderly development.

In designing campsites, for example, our perfect market knowledge tells us to plan "big sites with vegetation between them," because "people want lots of room and privacy" when they camp *(Hopkins 1966)*. And yet numerous studies during the past 10 years have suggested that sociability, more than outdoor resources, provides the main motivation for camping *(Etzkorn 1964; Burch 1965)*.

Our professional compulsion to plan constantly conveys the message that tomorrow's problems are more important, more amenable to solution, and more attractive to study, than are today's problems. And because today's problems are too urgent for research, millions of dollars are spent annually in the pursuit of such perfect planning myths as the idea that public acquisition equals resource protection.

THE RATIONALITY OF RECREATION RESEARCH

While the fogweed of leisure and outdoor recreation makes the research task difficult conceptually, the mythology of science can be just as crippling procedurally. The myths of "scientific freedom," "scientific objectivity," 'scientific omnipotence," and the idea that there are some "grand theories" just waiting to be discovered that will readily simplify complex behavioral phenomena, along with some widespread misconceptions about social and statistical "significance" are a few of the more devastating species of scientific fogweed.

A recent LIFE magazine article nicely summarizes the mythology and the reality of science:

> One expects scientists to provide the truth, scientists being dispassionate men who can eliminate prejudice and emotion and tell us what is really going on here. But one learns that at the sticking point, science breaks down, and the scientists are sometimes wrong, frequently biased, and usually incapable of agreeing among themselves.

From the number of popular anti-science books that have appeared during the last year or two, we can assume that at least a vocal minority is communicating its distrust of science! A number of problems for recreation research, including a lack of public support and a reduced willingness to cooperate with researchers, may result. A common complaint seems to be based upon science's cherished "objectivity." There is, for example:

> ". . . A growing reaction against science and technology . . . a mounting feeling that science and technology create a cold, artificial, impersonal, dehumanized, and even monstrous world . . . a revolution against the machine and everything machine-like and . . . a revolution against a system . . . a revolution on behalf of the individual and individualism, against the invasion of privacy . . ."
> *(Waldo 1968)*.

Outdoor recreation research may already be reaping some of the rewards of this new scientific revolution. Refusals to cooperate with researchers—to be interviewed, for example—though still infrequent, seem to

be more common today than they were 3 or 4 years ago!

There is some legitimate question about how much scientific freedom actually exists with the scientist's subcultures constantly communicating their expectations to him. The "publish-or-perish" admonition, true or not, is the expression of a powerful cultural norm that effectively limits scientific freedom.

Subtle but apparently very effective communications within the subculture of outdoor recreation agencies clearly influence the types of research that will be conducted and supported.

I recently examined two lengthy bibliographies of outdoor recreation studies. These bibliographies listed 25 papers and reports on the problem of counting visitors at recreation areas. Twenty-three of the papers were by agency-employed scientists. Although the other two were done by university personnel, one was a cooperative study with a federal agency, and the other was done by an ex-Forest Service scientist.

Since public recreation agencies measure success by counting heads *(Goodale 1967)*, the conclusion from this disparity in problem recognition between agency and university scientists should be obvious. That conclusion seems to be saying something about scientific freedom.

The logic behind which problems are selected for study, and the methods that will be used to study them, can be very convincing if not always rational. Logic and rationality are not synonomous; in fact, even paranoid thinking is quite logical once you accept its irrational underlying premise *(Braden 1970)*.

There are sound (If you accept the underlying premises) reasons for studies that will yield better estimates of recreationists. A park manager may be receptive to these studies if he happens to see in them a better way of: (1) identifying distributional problems and overloads, (2) justifying additional employees and new services, and (3) justifying new rules and regulations to protect the resource and the visitors *(LaPage 1967)*. The highly debatable underlying premise is that we have to play the numbers game to do any of these things. With today's emphasis upon environmental quality, it may be that there are more efficient and more appropriate ways of achieving these ends.

Perhaps the most scientific of the underlying premises is the exaggerated concern for representivity through better user-counts and more complete visitor rosters, at the expense of a frequently inadequate concern for the phenomena being sampled and measured. Here we see the fogweed of scientific objectivity in full bloom.

Nose-counting studies, tests of different procedures for raising the level of use of wilderness trail registers, and comparisons of the data collected by interview and mail questionnaire all share an assumption that better sampling means better research. Unfortunately the premise is incorrect.

No list is ever complete. But, more important, no list can contain the important small-group and situational elements that create most outdoor experiences. An after-the-fact response, framed in the privacy of one's home, is likely to be much different than one that is drawn from shared opinions around a wilderness campfire! If we really hope to learn the why of different forms of outdoor recreation, we are going to have to use appropriate units of observation. And, I suspect, the on-site-group is in most instances the appropriate unit, despite its formidable sampling problems.

Probably the single most troublesome piece of scientific fogweed is that perverse word: *significant*. "Statistical significance of a correlation coefficient, or a regression coefficient, merely means that there is a pretty good chance that it is in fact a number different from zero . . . One should not exaggerate the worthwhileness of a coefficient simply because it probably differs from zero" *(Ehrenberg 1970)*.

Statistical significance says nothing about the adequacy of sampling, and nothing about the validity of the measuring tools used. And since sampling and measurement are generally acknowledged to be the two major problems of recreation research, "significant" relationships, at this stage of the game, must be regarded as the beginning of understanding and analysis, not the end.

For sound research planning, I would gladly swap all the "highly significant" correlation coefficients of the past 10 years for a handful of good case studies that yielded some solid conceptual insights to build on.

FOGWEED AND THE FUTURE

It may be trite, but it is still true that many of our problems are due to communications failures – either too little or too much. Usually the charge is "too little communication," or a failure to communicate at all. If we regard all of culture as communication, then possibly many of our problems may arise from too much communication–an informational over-kill. We have literally talked some of our problems into existence.

Whenever a group of experienced outdoor recreation administrators are discussing their problems of counting people, or of soil compaction in campsites, it takes a rare research consultant to admit that he can't see the problem. Perhaps, at first, he doesn't. But subtle social pressures will eventually force him to see the problem with the same set of blinders that they wear. Obviously, if a real problem does exist, this sort of acculturation is destined to reduce the number of possible solutions, because he will then also see their barriers to problem solving.

And then, while the researcher goes off to wrestle with the administrators' problems, they may go into another huddle with their information specialist to draft a bigger and better promotional campaign for next year.

An awareness that culture is communication is not, by itself, going to help solve any problems. But, it does stress the realization that problems are seldom what they seem to be upon first inspection. The administrator's concern for the condition of his resource is not equivalent to the condition of that resource. It is, more nearly, his impression of its physical condition exaggerated by his apprehensions for the future; both of which contain more than a pinch of fogweed.

The challenge of recreation research, it seems to me, is not how to minimize or maximize the amount of information received, or even how to process it more efficiently. The challenge is to recognize the fogweed. Stated another way, the challenge is really to disprove Kenneth Boulding's half serious definition of science as: "the process of substituting unimportant questions that can be answered for important questions which cannot" *(Boulding 1956)*.

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AN OPINION ABOUT THE FUTURE OF FOREST RECREATION RESEARCH

by JOHN F. HAMILTON, JR., *University of Indiana, Bloomington, Ind.*

ABSTRACT. A discussion of the research environment, with emphasis on the quality of future research. Some current research attitudes are criticized and a suggestion is given for increasing the value of research.

IN THE LAST several years, the concept of a *system* has received great attention in many different areas of research. Analytical enterprises falling under such headings as operations research, decision theory, cybernetics, dynamic programming, and information theory (all of which are heavily interrelated) depend upon a system within which to work. Thus, when considering problems of long-range planning for forest recreation, it is quite reasonable to approach them by researching the system in which they occur.

It is unfortunate, however, that the research and administrative agencies that devise and implement decision strategies also form a very large system. It is this point I wish to discuss first. In a recently published speech (Science 172:491-494; 1971) Prof. Richard Bellman of the University of Southern California, a pioneer in dynamic programming and recipient of the first Norbert Wiener Prize in Applied Mathematics, observed that:

> . . . we have begun to understand our society is a contrast of interconnecting, interacting large systems, and that so many of the difficulties that we see today are the difficulties, not of inherent theory, good theory, bad theory, not of conspiracy, but just the difficulties due to large systems. I think it's beginning to be realized that our systems are falling apart. We don't know how to administer them. We don't know how to control them. And it isn't at all obvious that we can control a large system in such a way as one remains stable. It may very well be that there is a critical mass—that when a system gets too large, it just gets automatically unstable. The problems then we see in our medical systems, in our educational systems, in our legal systems, in our transportation systems, in our garbage collection systems, all the systems you can probably think of, these are problems of instability.

If Bellman's conjecture about a "critical mass" is correct, it may very well be that the forest recreation system (a very large system) does not have a stable control mechanism. For such a system with unstable control I think the concept of "long-range planning" is at best a fantasy, and probably just meaningless.

Suppose, however, that the Forest Recreation (FR) system *does* have a stable control mechanism; and suppose further that the FR system and the nature of its controls are fully understood. The long-range planning and control of the FR system might still be jeopardized. The threat, in this case, would come from the stability problems inherent in the system that promotes research in FR, formulates planning for FR, and administers Control of FR. Call this the RPC system.

For an analogy, consider an automobile

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as a system. As we all know, it is a reasonably small system and, under normal conditions, has a stable control mechanism. Now consider an automobile being operated by a committee of 15 people. Let different people control the accelerator, brakes, and steering wheel. Let some be in charge of looking out the windows and others of keeping an eye on the fuel gage and speedometer. Finally, let the rest of the unassigned committee members circulate around and help out wherever they see fit.

It should be clear in what sense the future of this car is in jeopardy. In reality, the situation would probably be worse because additional internal problems would arise such as a dispute over what constitutes safe driving, a contest between the gas-pedal man and the brake-pedal man to see whose function is more influential, or a front window viewer who just doesn't know the significance of ice on the road.

THE FR AND RPC SYSTEMS

It seems to me that, of the two systems—FR and RPC—the more sensitive and influential with respect to FR planning is *not* FR but rather RPC. Stated another way, my contention is that facts about the RPC system are more significant in the researching, planning, and controlling of the FR system than are facts about the FR system itself. There are even some aspects of RPCing FR which are completely independent of factual input from the FR system.

First, there is always the kind of situation in which a well-researched and well-formulated recommendation for planning or control is not implemented. Budgetary or manpower restrictions, previously adopted policy commitments, and even personal philosophies can easily cause a timely suggestion or plan of action to go unheeded.

Second, the selection and presentation of appropriate research is very susceptible to influence by the ideas and opinions currently embraced by members of the RPC system. A researcher, for example, may be unwilling to accept as valid the test results that falsify his conjecture, or may be too eager to accept as significant other results that support it. A planner, too, may be reticent to give adequate consideration to researched recommendations that, in his opinion, point in the wrong direction. As in any scientific enterprise, the results of an observation depend directly on the current theory, which means that it is very easy to see what you want or expect to see.

Finally, the evaluation as to whether or not a particular proposition or problem is researchable depends heavily on facts about the RPC system. More concretely, those areas of investigation that can qualify as targets for research are more likely to be found in the FR system than in the RPC system (which I have argued is the more significant of the two). It would be interesting to see more research on such questions as; "What is the actual working structure of the RPC system?", "What are the actual criteria used by its decision-makers?", and "Is the current hierarchical structure of the RPC system the one most compatible with the system's assigned functions?". I think questions like these will have to be dealt with if future planning is to be very effective.

In one sense, of course, there always has been and always will be long-range planning in the FR system. The sense I refer to is the stipulative or prescriptive sense of planning, such as planning a vacation or setting up a schedule for car payments. Such planning, however, merely predetermines certain aspects of the future and cannot, by itself, respond to the effects of any intermediate events. Notice also that under this interpretation almost any decision with long-range effects can be considered as "long-range planning."

At the other extreme, we could think of long-range planning as the formulation of optimal strategies giving rise to control that is sensitive and responsive to intermediate events. In this sense, long-range planning will probably never happen in the FR system unless drastically simplifying views of its structure can be found. The status of planning will always lie somewhere between the two extremes. To the extent that planning is going to be responsive, research will be needed to yield foresight and planners will have to ask well formulated questions. To the extent that planning is going to be prescriptive, planners will use research to vindicate their

actions and researchers will produce hindsight.

A MODEST PROPOSAL

Somewhere along the line, the idea arose that for one's work to be "scientific," it had to be precise, cautious, and empirically well grounded. Apart from being false, this view is all too easily taken to mean "if it's wrong, it isn't scientific" (or words to that effect). One side effect of holding such a view is the production of "not-wrong" research, which I call "safe research."

Safe research is almost always publishable (as a research note if nothing else), and thus is of value to the researcher himself if to no one else. Safe research most easily arises by researching tractable questions rather than questions that need answers. In the event that no tractable questions are available, the researcher may well make up some, or worse, may simply produce the research results and then work backward to find the question that "was of interest."

If this last statement seems a bit harsh, I would point out that in a statistical analysis, for example, any dickering with the confidence levels after the fact may amount to exactly what I've described. In any case, in long-range planning and control, research that is safe in the short run is most probably *not* safe in the long run.

Scientists, however, are people. They realize that their survival as scientists depends not only on their scientific skills but also on their ability to serve and preserve the hand that feeds them. In the opinion of J. R. Pierce (Bell Telephone laboratories, Murray Hill, N. J.) which appeared as a recent editorial in Science magazine (April 1971):

> In the end, most scientists will do whatever there is money for doing. Scientists know, or should know, which socially and economically useful goals are within reach and which have a good chance of accomplishment through promising research. Yet, in their personal and collective actions, scientists often seem more concerned with the total number of dollars, with the public image of science, and with the cry for certain specific results than with the sensible selection and vigorous pursuit of fruitful areas of research and application. It will be a sad thing for scientists if they fail to choose wisely and act energetically toward valuable and attainable goals—for, if they do not choose what they shall do, others will choose for them.

The initiative for change, then, is to be placed most squarely upon the shoulders of the scientist. But what is a reasonable first step for him to take?

My recommendation for improving the situation in forest recreation requires individual participation on the part of researchers; and moreover, since good research cannot be legislated or capsulized into a research cookbook, each researcher's participation will have to be unilateral. He will have to stand alone. I ask that he make a concerted attempt to produce *fully interpreted* research results.

This involves suggesting applications and speculating on outcomes. It involves saying things that might be wrong rather than safe. If he uses factor analysis or least-squares curve-fitting (or both), he might spell out what he feels the factor loadings signify in his case (if anything), or in what way he would recommend using his regression equation.

Instead of politely backing off from the question of application, the researcher should be aggressive and should be willing to go out on a limb to a certain extent. He might also include an estimate as to when his data will no longer be accurate ("Is it good forever?"; "Is it good for 3 or 4 more years?"; "Is it already inaccurate at the time of publication?").

Please notice that I am *not* asking the researcher to be correct in all his speculation. I am simply asking him to shoulder his fair share of the risk involved in the application of his own research. It is hardly fair to ask a planner to place confidence in someone's research if the researcher himself isn't willing to do so. Even though some good research will not have immediate or imminent application, I think that a researcher should consider himself co-responsible for any application (or *lack* of application) of his work.

Such an attitude would lead to the appearance of more publications in which the investigator could conclude by saying "more applications in this area are possible" instead of the usual "more research in this area is necessary."

EXPANDING & STRENGTHENING OUTDOOR RECREATION RESEARCH

by WALTER S. HOPKINS, *Chief, Branch of Forest Recreation and Related Human Environment Research, Division of Forest Environment Research, Forest Service, U. S. Department of Agriculture, Washington, D. C.*

ABSTRACT. Though the Forest Service has pioneered in outdoor recreation research, the funding for recreation research has been inadequate. Specific needs for research are outlined. There is a need to define recreation and recreation research in terms that busy legislators can understand.

SIXTEEN YEARS AGO it was evident that visits to America's forests and parks were no longer a minor and incidental resource use. Fifteen years ago the Forest Service started a program of recreation research by hiring Dr. Sam Dana to develop the first problem analysis for outdoor recreation research. Twelve years ago the Eisenhower administration launched the Outdoor Recreation Resources Review Commission. Nine years ago the ORRRC reports urged considerable expansion in recreation management and research.

Now it is 1971, and the Forest Service program of recreation research started by Sam Dana in 1956 continues as the only organized program of research attempting to span the broad field of outdoor recreation—in or out of the Government.

Before you look upon that as a bragging statement, let me point out (1) that the Forest Service has eight programs of research dealing with major forest uses and major forest problems (such as fire, insects, watershed, timber, wildlife, and range), and (2) that the Forest Service program in recreation research has a firm position at the bottom of the list in terms of financing and scientific manpower.

For example, the Forest Service employs 270 professionals in timber-management research and 21 professionals in recreation research. The research of the 270 scientists in timber-resource research is much needed. My point is that a comparable number could be used effectively in recreation research.

In 1962 the Outdoor Recreation Resources Review Commission determined outdoor recreation to be a $20-billion industry (it is at least $30 billion today), and Congress established the Bureau of Outdoor Recreation and authorized it, among other tasks, to conduct and sponsor outdoor-recreation research. Considering the magnitude of outdoor recreation and its impacts, we can ask: Why is recreation research so poorly financed?

MUST WE HAVE FUN?

Support for almost any research one can name is made available because those who provide the support can see a clearly defined need. We *must* control forest fires. We *must* have more timber. We *must* have good, clear water. We *must* beat the Russians to the moon—and we did. To date,

despite all the chest-beating about the therapeutic benefits of recreation, no one has yet documented recreation as a commodity that society *must* have.

Part of the problem rests in the term *recreation* itself. Health we must have. Food we must have, Recreation, maybe. Recreation connotes fun. Do we *have* to have fun? Dr. Phillip O. Foss, at Colorado State University, has pointed out that the founders of our American society ". . . brought with them a concept of the nobility of work and the sinfulness of idleness." He also pointed out that one of our popular hymns is "Work for the night is coming"; and that the "idle rich" were resented not because they were rich but because they were idle.

Though many may not look upon recreation as immoral, neither do they consider it necessary. It is not hard to see why the U.S. Congress, State legislators, and other fact-finding groups find it difficult to appropriate money to research "fun"—to research frivolity. In fact, we have been asked by members of appropriations committees, "Isn't there some way you can keep all of these people out of the woods?"

What can you and I do? First, we should recognize that the term "recreation" at this point in our culture does not have the magic appeal some of us thought it had 10 years ago. Perhaps it will in another few years; but for now we might fare better by taking an environmental approach to this need. Man and his family are going to continue to come to the forests, beaches, and parks in great numbers. As they do so, they are going to have an impact upon and be part of the environment—theirs, yours, and mine. It is just as necessary for these people to understand, cope with, and benefit by the outdoor environment as it is for the environment to cope with them.

I think two approaches should be made: First, I believe a general approach of "Man and his interactions with outdoor environments" will yield more than one of "Man and his need for outdoor recreation." Second, I think we should pinpoint opportunities as they present themselves. (As I talk about pinpointing and opportunities, please do not look upon this as an essay on politicking, but as examples of "the way it is"—and for us in recreation, perhaps the way it can be. Congress and other legislating bodies, despite all the criticism they receive, are dedicated hard-working people. We can be grateful that they must be convinced of a need before they loosen the purse strings—or your taxes and mine would be 10 times as much as they are now.

An excellent recent example of pinpointing was Rachel Carson. Almost immediately after the publication of SILENT SPRING, funds for pesticide research were made available. More recently, funding for pollution research has improved. We should recognize and remember these examples as we seek strengthening for recreation research.

RESEARCH NEEDS

Now for a few examples of specific recreation research needs.

1. Recreation is a "people" subject. Most of us are pretty adept at managing trees and turf, but our real task is people. We can learn a lot through experience. But through research we can move faster. We need to be much better able to understand recreation visitors, their interests, their motivations, their perceptions. These are rather nebulous items. I cannot see Congress enthusiastically providing funds to study "motivations." But I can see their supporting studies of vandalism, littering, and related unbecoming behavior. And this would be a good place to start.

2. Outdoor education, interpretation, and communication. Millions are spent annually on outdoor education and related communication programs, yet until 2 years ago, when Wagar started some interpretation research, no one was conducting research in this area. Again, interpretation research is sort of vague. But I believe most of our legislators recognize the great need for instilling in our visitors a stronger conservation conscience and a more meaningful understanding of ecology.

3. Closely related is the need to present today's absurd clean-up and maintenance costs. We need much better public cooperation; and research can help show the way. The Forest Service now receives $40 million for recreation management, and $30 million of this is going for clean-up and maintenance! And this $3 out of $4 relationship is not unique on the National Forests. The need for research here should not be hard to explain.

4. So long as we continue to have 200 million people in this great country, and so long as we attempt to maintain something resembling our present standard of living, not very many of us are going to be able to go back to nature. It will be necessary to produce wood and other commodities from most of our better forest lands—but this does not mean that these lands cannot remain or be made beautiful and used and enjoyed by recreation visitors. What it does mean is the need for more forest-landscape management research – both in design and application. This is not a vague topic, and it should not be hard to explain.

5. What are the human benefits of outdoor recreation? Most of us are convinced that playing with a group of kids in a park is far better than having police chasing the kids in the streets. Isn't it time we documented the benefits (if any) of forest and park experiences for our youth? Several key legislators are interested in this; but they need some solid, sincere, grass-roots support.

We can ask: "How can the private and public sectors of outdoor recreation be better coordinated?" "How can we encourage uses more compatible with the resource?" "Can we develop acceptable methods for considering intangible values as we make land-use decisions?" "What are the economic impacts of various recreation development alternatives?"

We could ask many more key questions, but these are more than enough for today. What we need to do is to define recreation and recreation research needs in terms that a busy legislator can understand, can be convinced of, and can convince others of. We can do it, and we cannot start any later than today.

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THE CHALLENGE OF RECREATION PLANNING: METHODOLOGY AND FACTORS TO CONSIDER

by RONALD B. ULECK, *Research Associate, Department of Forestry, University of Illinois, Urbana, Ill. This paper is adapted from a Ph.D. dissertation, "Guidelines for preparing development plans for public resource-based outdoor recreation areas." submitted to New York State University College of Forestry at Syracuse University, Syracuse, N. Y.*

ABSTRACT. The proposed methodology of planning is a description, explanation, and justification of the methods or techniques that a planner should use in preparing outdoor recreation development plans. The sequence of steps required is described.

INTRODUCTION AND SCOPE

OUTDOOR RECREATION planning is a broad and complex activity. This paper deals with one aspect of that activity: development planning – that is, planning of the natural resource base to change its potential capacity for providing recreational opportunities. The primary orientation is toward providing guidelines for planning an individual outdoor recreation area or complex such as a state, county, or regional park. The planning guidelines are developed for large resource-based recreation complexes located in a rural environment and developed primarily around an extensive natural resource base that, in itself, provides opportunities for outdoor recreational activity.[1]

The primary focus is on public recreation areas, although the guidelines can be applied (with minor adjustments) to private areas. The principal audience addressed is the group of persons who prepare development plans for public outdoor recreation areas. The guidelines are broad enough to be applicable to a wide variety of natural resource bases.

In this paper, public outdoor recreation development planning is defined as a rational and systematic process, integrated with all the important social and physical factors, for determining appropriate action in developing the natural resource to provide outdoor recreational opportunities.[2]

The guidelines were developed from several sources. General planning theory, methodology, methods, and techniques for various kinds of planning (e.g., urban, enterprise, and military) were reviewed, integrated, and adapted to planning public recreation. Literature on all phases of outdoor recreation planning (theoretical and applied studies, and recreation proposals and plans) proved to be valuable sources of information, since they are directly related to the subject of this paper. Related subjects such as forestry and land-resource economics, economic growth and development, consumer economics, and decision theory, were also used to develop the guidelines.

The guidelines are designed primarily as a methodological tool for planning, and thus are not a detailed presentation of the

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various methods and techniques that can be and are used in planning.

PROPOSED METHODOLOGY

The proposed methodology of planning is a description, explanation, and justification of the methods or techniques that a planner should use to prepare outdoor recreation development plans.

Methods function to help the planner form concepts and hypotheses, make observations and measurements, build models and theories, provide explanations, and make predictions. Methodology aids the planner in understanding and undertaking the process of scientific inquiry by which he develops a plan.[3] *The planning process is an organized sequence of steps requiring conscious and continuous action.*

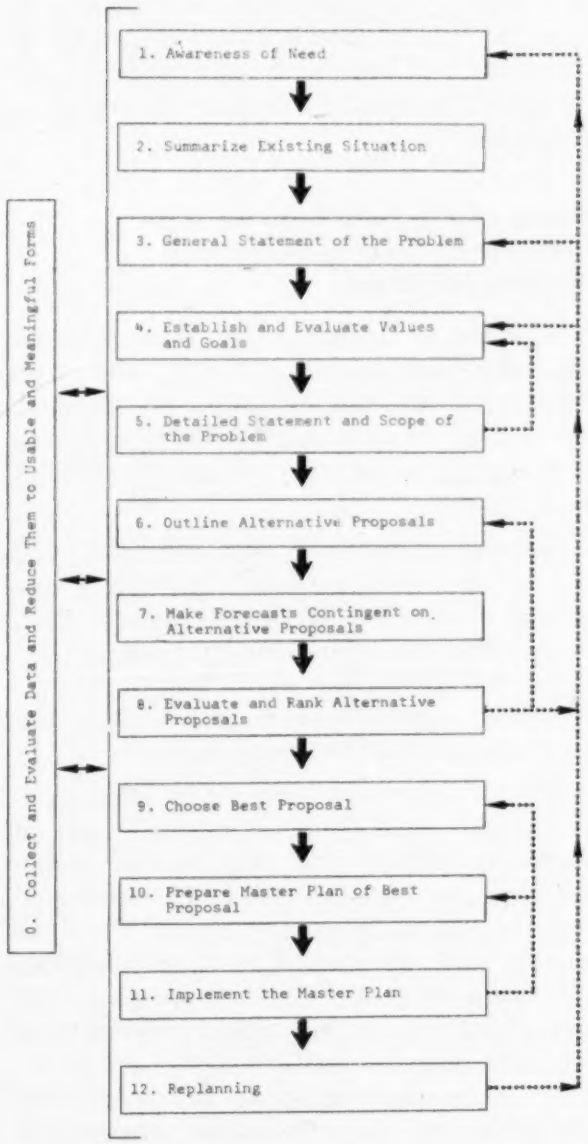
The methodology described here is oriented toward the planner whose concern lies primarily with preparing a master overall plan that takes into account all major social and physical factors of outdoor recreation development planning. These factors are intimately related to the methodology of planning. Examples of where and how some of these factors fit into the methodology are given in the planning steps outlined in this paper.

The master planner should *not* be burdened with the "nitty-gritty" concerns of specialists (e.g., the color to paint picnic tables, the composition of materials for road pavement, or recreation activity programming for weekend campers), for these tasks are performed only after a master plan has been prepared. He must, however, recognize that extent to which these concerns affect the development of the master plan.

STEPS IN THE PLANNING PROCESS[4]

Figure 1 shows an organized sequence of steps in the Planning process. Heavy arrows (⟶) show the order in which the steps are performed. Dashed arrows (- - ➔) show some of the major feedback linkages between steps, that is, interdependencies between each step and preceding steps.

Figure 1.—Steps in the planning process.


1. Awareness of Need
2. Summarize Existing Situation
3. General Statement of the Problem
4. Establish and Evaluate Values and Goals
5. Detailed Statement and Scope of the Problem
6. Outline Alternative Proposals
7. Make Forecasts Contingent on Alternative Proposals
8. Evaluate and Rank Alternative Proposals
9. Choose Best Proposal
10. Prepare Master Plan of Best Proposal
11. Implement the Master Plan
12. Replanning
0. Collect and Evaluate Data and Reduce Them to Usable and Meaningful Forms

The planner may enter the process at any of several steps. If the planner's task encompasses all the steps in the planning process, he may begin with step 1. If someone else in the political decision-making hierarchy (e.g., the director of the agency within which the planner is employed) has actually initiated the planning process to the point of setting goals for recreation development (see steps 1 to 4), the planner, because he must frequently accept the directives of his superiors, would begin his analysis with a detailed statement and scope of the problem (step 5). In situations

where each step in the planning process is performed by different individuals or agencies, the importance of performing all the steps in figure 1 in an organized and integrated sequence cannot be overemphasized.

Step O. Collect and Evaluate Data and Reduce Them to Usable and Meaningful Forms

The use of adequate data is an absolute necessity for sound planning. But data frequently are not available, coordinated, up-to-date, or in usable forms. In addition, data related to personal values are difficult to interpret.

Sources of available data are many and varied. In addition to data generated and possessed by the planning agency itself (e.g., from household surveys, on-site surveys, and inventories of the supply of recreational opportunities), many other informational (data) sources exist.

Federal, regional, state, and local governmental agencies have a broad base of data—for example, that possessed by census bureaus and agencies concerned with economic development, transportation, research and development, social services, soil conservation, civil engineering, and parks and recreation. Quasi-governmental agencies such as public utilities almost always have information on the spatial distribution and socio-economic characteristics of local populations. Information about specific aspects of recreation planning can also be acquired from colleges and universities and their cooperative extension services. Private businesses in recreation and related industries can also provide valuable information. Planning documents for other recreation areas can provide insights into the planning problem at hand.

Many types of data and the relationships among them prove relevant for planning. Data are needed for all the major social and physical factors to consider in outdoor recreation development planning. The following list identifies the types of data needed:

1. The institutional and social setting of the planning process.
2. Inventories of the existing natural and man-made features of the planned recreation area.
3. The supply of existing recreational opportunities on the planned recreation area.
4. The supply of recreational and other opportunities of other recreation areas and the local community.
5. The methods for increasing the supply of recreational opportunities on the planned area.
6. The consumption of recreational opportunities – present consumption levels, future consumption levels, and models to determine consumption levels.
7. Supply-consumption relations.
8. Land-use patterns surrounding the planned recreation area.
9. Site-planning data.
10. The impacts of recreation developments on local and regional communities—economic impacts on the private sector and on local governments, impacts on other recreation areas, and social impacts on local communities.
11. The relations between recreation development planning and management planning—management to control recreationists' use of the planned area, management of all the natural and man-made features of the area, water resource management, promotional policies, public relations, etc.
12. Data on financial planning.

Data should be evaluated for their accuracy and importance and should be interpreted and reduced to usable and meaningful forms that will facilitate preparing the master plan. *Data must be integrated into and used throughout the planning process.*

Step 1. Awareness of Need

The actual planning process begins with an awareness of a need for planning. This need ultimately stems from a community's[5] dissatisfaction with existing and planned recreational opportunities. That is, the

community has a "felt difficulty" or "need" based upon the difference between the existing situation and some ideal situation. At this step in the planning process, the need is frequently not clearly stated. But a need is expressed to the planner by the community or by someone in the political or organizational hierarchy. The planner, of course, may be the first person to recognize such a need.

Step 2. Summarize Existing Situation

A general summary and history of the existing situation provides the background for a clear awareness of the need for planning and for an explicit statement of the problem. Some factors that should be considered are: community aspirations, the supply and consumption of recreational opportunities, and a broad framework of unrefined data pertaining to the planned complex and to the community. The summary and history of the existing situation also provide a feedback of the impacts of current plans and policies, help to initiate the formal planning process, and are necessary for setting the planning problem in context.

Step 3. General Statement of the Problem

A general statement of the problem serves many purposes. It presents the basic considerations and concepts underlying recreation development, enumerates conclusions that were previously stated as working references, expresses judgments and suggestions for periodic and constructive review, and formulates the planning problem as a basis for the master plan.[6] In other words, this step provides a clear overview of the whole planning problem.

More specifically, the purposes of a general statement of the problem are:[7]

1. To recognize the discrepancy between ideal and existing conditions.
2. To identify the overall problem and provide a broad overview of the social and physical factors to be investigated—e.g., the consumption and supply of recreational opportunities and the impacts of recreation development on local communities and the natural resource.
3. To provide an objective look at problems that had previously been matters of conjecture.
4. To give initial direction to the whole planning process.
5. To identify the problem as potentially actionable, that is, to formulate possible and realizable solutions to the problem.
6. To postulate future courses of action on the planning problem.

Step 4. Establish and Evaluate Values and Goals[8]

The process of establishing and evaluating values and goals cannot be taken too lightly, for this step sets the stage for succeeding steps in the planning process. Values and goals, whether considered explicitly or not, determine the overall direction of the planning process once a general statement of the problem is expressed.

Values can be expressed as moral statements ("A recreation area 'ought to' provide recreational opportunities for everyone"); preference statements ("Plan A 'is preferred to' Plan B"); goal statements ("Providing recreational opportunities for persons of all age groups 'is the goal of' Plan A"); or criteria statements ("For choosing between Plan A and Plan B, choose the plan that minimizes financial costs to local governments"). Recognize that values are intimately related to facts (descriptions of what things are). That is, values and facts are affected by each other.

Requisites[9] are a category of values that specify limits to goals and the means by which goals may be realized and indicate what necessary conditions must be met in order for plans to be accepted. Requisites can be expressed in terms of feasibility (the fiscal, legal, and social conditions needed to implement a plan) and immediacy (the priority assigned to a plan in relation to existing social conditions). When specified levels of goals are to be attained, requisites are called constraints.

Values of individual persons are important for planning. But the planner operates within the framework of widely held public values such as conservation, preservation, and development of natural resources to best

serve the public's long- and short-range interests in providing recreational opportunities. Notice that these three values may conflict with or complement one another.

To facilitate choice among values and combinations of values, the conflicting and complementary natures of values must be reconciled. This can be accomplished by structuring a value hierarchy, a list of value priorities of an entire value system. To form a value hierarchy, values need to be expressed in rather specific terms that give clues to their source, history, and relevance.

When values are conflicting, that is, when some of one value has to be given up or traded off for another value, a value hierarchy can point to, reduce, or even eliminate inconsistencies among values in pursuit of a set of goals. Wherever possible, value hierarchies should be structured to provide a basis for establishing goals. Stating values explicitly and ordering them in terms of priority provides a framework for their appraisal and lends to their being transformed into objectively measurable goal statements.

A goal is an aim toward which planned action may be directed. Goals should imply commitment and reflect careful study, for they determine action proposals and the entire course of the planning endeavor. Furthermore, it is important that determination of goals assume equal importance with the ways in which they are to be attained.

Goals are dichotomous in that they can be expressed as either ends or means, depending on how responsibilities and concerns are specialized and the point of view adopted at a given time. Ends are aspirations for preferred states. Means are the ways in which ends are achieved. In any given goal chain (where each goal is a means to achieve higher level ends), a goal is an end when viewed from below in the chain and a means when viewed from above. To illustrate a typical goal chain, the goal "To limit the number of persons using a park at any one time" is an end in itself, but it is a means to "Conserve natural resources in the park by limiting use" which, in turn, is a means to "Achieve maximum community welfare."

Examples of realistic and explicit goal statements (that may be ends or means) for recreation development are: to maximize efficiency in allocating natural resources for recreation, to maximize regional growth and stability, to provide recreational opportunities for specific groups of people in the community, to maximize total use of the natural resource for recreation, and to preserve the natural resource for future generations. The goals of the plan should be established in a systematic manner. First, define the scope of concern and responsibility of the planner. Justify why some goals are accepted while others are rejected. Carefully choose goals that reflect the thinking of the community for which the plan is prepared.

Second, outline the range of choice of goals. Establish ultimate ends to which planned action will be directed, such as the ultimate end to maximize community welfare. Set out various goal chains that are means to achieve ultimate ends.

Third, identify the relationships among different goal chains. Identify which goal chains (1) are means to achieving other goal chains—e.g., goals to limit accessibility to a recreation area may be a means of preserving the natural features of the area; (2) are conflicting and complementary—e.g., preservation and development goals may be conflicting, while the goals of preservation and conservation may be complementary; and (3) are more applicable to certain levels of the planning problem than others—e.g., conservation goals may be more applicable to long-range planning than are goals for developing picnic areas to accommodate a sudden increase in the consumption of picnicking opportunities.

Fourth, goals must be evaluated to facilitate choice among many different goals. Each means within a given goal chain should be evaluated in terms of how it affects progress toward the highest end goal in that chain in view of the land, labor, capital, and managerial resources available and in view of recognized constraints.

Goal chains must also be evaluated relative to each other. This implies structuring a priority ranking of goal chains in terms of how each goal chain affects progress toward achieving ultimate ends. Structuring a priority ranking requires a clear understanding of the ultimate ends that

goal chains serve and of the relative value assigned to ultimate ends.

Several independent ultimate ends can act as time constraints on goal chains that serve them. That is, goal chains cannot always simultaneously serve many ultimate ends. For example, a goal chain designed to "provide the maximum total number of recreational opportunities" may effectively serve the ultimate end of "providing recreational opportunities for all potential recreationists," but it may not simultaneously achieve progress towards the ultimate end of "providing the maximum number of recreational opportunities for certain kinds of recreationists such as fishermen."

Choose the means within each goal chain that best satisfy the end of the chain. Choose the goal chains that contribute most to the ultimate ends of the community. Given alternative goal chains (means) for achieving a given ultimate end, choose the goal chain that (1) most closely satisfies the ultimate end, (2) is most consistent with other goal chains, (3) is most manageable in terms of on-the-ground operations, (4) minimizes financial and social costs, and (5) has the greatest likelihood of achieving the ultimate end.

One remaining aspect of setting goals is to make goals operational; that is, to present them in a manner acceptable to the community and in a way that will enable succeeding steps in the planning process to functionally utilize them. Operational implies that progress toward goals can be measured objectively and that all costs and benefits of striving toward goals can be foreseen and estimated. Goals that lack operationality are difficult to communicate intelligently.

Some ways to make goals operational are:

1. Make goal statements clear and specific —e.g., use "The goal is to develop a variety of recreational opportunities throughout the park for all age groups of people" rather than "The goal is to develop recreational opportunities."
2. State goals in terms that will indicate constraints, benefits, and costs. For example, the goal "To develop a variety of recreational opportunities throughout the entire park for all age groups of people" gives some indication of: (1) constraints—no one type of opportunity nor age group dominates the plan; (2) benefits—recreational opportunities will be provided for people of all ages, and all land resources will be used; and (3) costs—possibly no part of the park will be "preserved"—providing recreational opportunities for all age groups may be more expensive than providing only a few types of opportunities for selected age groups.
3. Combine related goals to give specific direction to each part of the overall plan.
4. State short-range goals (within the context of long-range goals) whose effects on the community are immediately apparent.

Step 5. Detailed Statement and Scope of the Problem

Once Step 4 is performed in view of a general statement of the problem, a detailed statement and scope of the problem can be outlined. In this step the planner decides what overview of the planning problem he should accept; that is, the scope of the problem. Here the planner is concerned with such matters as means-ends relationships, selection and use of data, recreationists to be accommodated, recreational and other activities affected by development of the natural resource, agencies involved in the planning process, determination of the planning region, and time horizons (short- or long-range) to which planning is directed. Each of these matters is important in a detailed statement of the problem. The following discussion on the planning region and time horizons will serve to illustrate how these matters are considered in a detailed statement of the problem.

Planning should be somewhat regional in scope. That is, it should consider not only the recreation area itself, but also the community and environment surrounding the recreation area. The planning region can change spatially or geographically over time. But the natural resources around which the planning process centers (e.g., wooded areas for camping and surface

waters for fishing) must be identified and defined to give clear direction to planning for the general design and spatial arrangement of recreational opportunities on the recreation area.

Explicit statements of the time horizons of various parts of a plan are important. Long- and short-range aspects of the plan must be coordinated. A certain amount of flexibility in the plan over time (that is, from the immediate to the distant future) should be included; for changes in values, goals, and the social environment may require changes (even major ones) in time horizons of individual aspects of the overall plan.

Step 6. Outline Alternative Proposals

This step is a synthesis of all the different considerations required for solution of the problem stated in step 5. The purpose of this step is to outline the different ways a recreation area can be developed in view of the goals, constraints, and resources identified in preceding steps.

All relevant major proposals[10] or alternative courses of action, including a "no-action" alternative,[11] should be outlined. If the planner limits himself to only one proposal, he may overlook other possible solutions to the planning problem. In some cases, however, only one way to solve the problem may be feasible, in which case only one proposal is outlined.

The financial and time costs of preparing more than one proposal may be limiting factors. These costs can be held to a minimum by considering only the most important aspects of each proposal and by limiting the refinement of data and unneeded detail in the analysis.

Each proposal should, however, include enough detail to enable evaluation of its major costs and benefits (see step 8). That is, each proposal should contain statements on such matters as: (1) the physical-spatial design of the recreation area, such as the number and location of campsites and the extent and distribution of the transportation network; (2) the recreationists accommodated—e.g., campers and fishermen; (3) the natural resources used in developing the area—e.g., surface waters, riparian lands, and mountainous lands; (4) relations with local communities, such as the amount of private property to be acquired for public use; and (5) the management practices required after the area is developed.

Step 7. Make Forecasts Contingent on Alternative Proposals

Before alternative proposals can be evaluated, forecasts contingent on the alternative proposals are required. These forecasts depend on what actions each proposal specifies as well as on forecasts of autonomous factors such as population growth and the general level of economic activity in the national economy. Constraints identified in the evaluation of alternative proposals (see step 8) should be imposed only *after* proposals are identified in step 6.

Forecasts of alternative proposals should include all relevant aspects that will aid in evaluating the proposals and in choosing the best one. For example, forecast the likely relationships between the consumption and supply of recreational opportunities, the effects of a recreation development on land-use patterns, and the management practices required for each proposal.

Step 8. Evaluate and Rank Alternative Proposals

Evaluating and ranking alternative proposals is a distinctly separate step in the planning process. The purpose of this step is to introduce greater rationality into the planning process in order to choose among proposals in an effort to maximize the attainment of ends stated in step 4. Because of the significance of this step for the planner, the following paragraphs include a brief discussion of some of the major methods and techniques that can be used to estimate the benefits and costs of recreation development proposals.

Methods for evaluating proposals are designed primarily to compare and rank alternatives, not to test their absolute desirability. If none of several proposals proves to be highly desirable, the planner may need to retrace step 6 and outline additional proposals. If no additional proposal is satisfactory, the problem should be

restated (step 3) and values and goals should be re-evaluated (step 4).

Criteria for the evaluation of each proposal include the following: (1) consistency of the overall proposal in terms of the integration of component parts; (2) internal consistency of each part of the proposal; (3) general feasibility of proposed actions; (4) resource requirements; (5) anticipated effects on the natural resource, the local community, and the recreating population; (6) availability of social and financial support; and (7) the degree to which different actions achieve stated goals.

Costs and benefits can be expressed in several ways, depending on how goals are stated. Some terms in which costs and benefits can be expressed are: (1) tangible and expressed in monetary terms—e.g., the dollar cost of constructing facilities; (2) tangible and expressed in quantitative, nonmonetary terms—e.g., the number of people that can be accommodated by a picnic area; and (3) intangible—e.g., the personal satisfaction derived from a recreational experience.

Identifying and evaluating the costs and benefits of a recreation development outlined in alternative proposals can be accomplished by using many different procedures and techniques.[12] A brief description of three techniques – traditional cost-benefit analysis, the "balance sheet of development," and the "goals-achievement" approach—for determining costs and benefits and the problems inherent in each technique will illustrate how alternative proposals may be evaluated.

Traditional cost-benefit analysis is derived from the theory of the firm. Costs and benefits are usually expressed in monetary terms. Some problems are inherent in the use of traditional cost-benefit analysis for determining the costs and benefits of public outdoor recreation development proposals.

Cost-benefit analysis is most applicable to situations where all costs and benefits of a given action can be identified and estimated. All costs and benefits of a large public resource-based outdoor recreation area sometimes cannot be identified, largely because of the changing nature of the natural environment and the social system that a recreation development affects and because the structure of the social system itself is difficult to determine.

For example, a major recreation development project is likely to alter the prices and outputs of many different goods and services throughout a small, local economy. In such a situation, all the effects (in terms of costs and benefits) of the recreation development on the social structure of the community, on recreation-related industries, and on other productive activities may be difficult to estimate.

Furthermore, use of cost-benefit analysis for evaluating investments in the public sector can be accomplished only if the following conditions are met: (1) barriers to the flow of funds and resources are minimal; (2) costs and benefits can be determined at market prices; (3) no external economies or diseconomies are present; and (4) no other external effects are created by the investments, such as social externalities in consumption (the notion that outdoor recreation contributes to, or is essential for, a well-balanced personal life that makes better and more productive citizens) that tend to enhance the welfare of the Nation as a whole.

These four conditions limit the applicability of cost-benefit analysis to public recreation investments. In the public sector, social costs and benefits (which are not easily measured by market prices) and intangibles (e.g., personal satisfaction) are important; and a minor importance is frequently assigned to economic efficiency.

Additionally, in order that cost-benefit analysis maximize economic welfare, one must assume that the existing income distribution is "best" and that costs are borne so as to maintain that distribution. The first assumption is questionable (but nevertheless made anyway) and the second is not likely true.[13]

Cost-benefit analysis, then, approximates maximization of public welfare only for those activities that can be priced in a market system. The analysis applies best to ranking proposals that are measured in the same costs and benefits. To choose among proposals, costs and benefits for each proposal are put in a ratio, and the

proposal that has the lowest cost/benefit ratio or the highest benefit/cost ratio is chosen.

A variant of cost-benefit analysis, "the balance sheet of development," is another technique for evaluating costs and benefits.[14] In this technique, all "good" and "bad" consequences of proposed actions are compared and all benefits and costs with respect to the social and natural environments are considered. A "balance sheet" is constructed which distinguishes monetary and non-monetary costs and benefits and identifies the sectors (e.g., public and private) that bear those costs and benefits.

A drawback of this technique, like cost-benefit analysis, is that it does not always enable evaluating proposals that incorporate a diversity of actions and that are designed to satisfy many independent goals. Proposals must have common grounds for evaluation. Goals must be well-defined and their desirability and worth must be assured. The "balance sheet" technique, however, has a broader perspective than traditional cost-benefit analysis because it does not rely so heavily on monetary costs and benefits.

Another technique for evaluating costs and benefits of alternative proposals is the "goals-achievement" approach.[15] Its key elements are the weighting of goals and groups effected (e.g., types of recreationists, the public sector, and the private sector) that were outlined in the scope of the problem.

Costs and benefits are always defined in terms of *goal achievement*, that is, benefits represent *progress toward* goals and costs represent *retrogression from* goals. The value of each cost and benefit is expressed in terms of each goal, and, where possible, the same units of measurement are used for each goal.

The final product for the goals-achievement approach is a "goals-achievement matrix." A typical goals-achievement matrix for three alternative proposals, each having one goal chain designed to maximize the same ultimate end, is shown in table 1. Here I, II, and III are descriptions of the highest goals in the goal chains for proposals 1, 2, and 3, respectively. The goal of each proposal is assigned a relative weight, which is derived from the priority ranking established in step 4. The groups of people, institutions, land resources, etc. affected by goals I, II, and III are identified by a, b. . . . e. These groups are assigned a relative weight derived from a priority ranking similar to that established for goals. The groups may be combined in any meaningful manner to show differential incidences of costs and benefits. The letters A, B, . . . are costs and benefits expressed in monetary units, non-monetary units, or qualitative states (e.g., the amount of personal satisfaction derived from recreational experiences).

Costs and benefits are recorded for each goal for each group affected. A dash (—) indicates that no cost or benefit would accrue if the proposal were put into practice. Note that a group may derive both costs and benefits with respect to a particular goal. For example, under proposal

Table 1.—*A typical goals-achievement matrix*

Goal	*Proposal 1*			*Proposal 2*			*Proposal 3*		
Description	I			II			III		
Relative weight	2			3			5		
Incidence	Rel. weight	Cost	Benefit	Rel. weight	Cost	Benefit	Rel. weight	Cost	Benefit
Group a	1	A	D	4	E	—	1		M
Group b	3	K		5	—	Q	2		—
Group c	1	J	H	3	—	F	3	N	—
Group d	2	—		2	T	—	4		—
Group e	1	—	K	1		U	5		P
		Σ	Σ					Σ	Σ

1, group a (say campers) may be provided with more campsites on a given tract of land (benefit D), while simultaneously incurring a loss of privacy due to the close spacing required for the development of additional campsites on that tract of land (cost A).

For certain goals, namely I and III, Σ indicates that summation of the costs and benefits is meaningful and useful. That is, total costs and benefits of proposals 1 and 3 are expressed in similar terms. Thus these two proposals can be evaluated relative to each other, especially when all costs and benefits are expressed in quantitative units such as dollars or numbers of campsites.

The goals-achievement approach is helpful for identifying and comparing costs and benefits of alternative proposals, especially the explicit listing of costs and benefits for each goal and each incidence group. But several problems are inherent in the approach. As mentioned above, the summation of costs and benefits can be difficult or even impossible. The whole approach breaks down when relative weights for goals and the groups affected cannot objectively be determined. The technique does not explicitly provide for or register interaction and interdependence among goals. The goals-achievement matrix becomes somewhat unwieldy when many proposals are included and when each proposal has more than one goal chain. And like the other evaluation techniques discussed above, costs and benefits can be difficult to determine, even in quantitative terms reflecting goal achievement.

Step 9. Choose the Best Proposal

After each alternative proposal is evaluated, the best one should be chosen. The best proposal is the one that most closely achieves, in terms of maximizing benefits and minimizing costs and in terms of recognized constraints, the goals set out in step 4.

Step 10. Prepare Master Plan of Best Proposal

Preparation of the master plan designed around the best proposal is one of the most rewarding experiences in the planning process, for it represents the culmination of the efforts of all previous steps.

The master plan is a statement of willful intention that sets forth accepted goals and the ways those goals are to be achieved. The master plan systematically outlines the actions that are to be taken in acquiring land, in designing and constructing facilities, and in structuring human behavioral patterns associated with the development plan.

The master plan need not (and probably should not) contain all the details of means-end identification. The plan should be somewhat flexible to accommodate change with a minimum of cost and effort. And it should serve as an instrument for evaluating and overseeing the actual physical development of the natural resource base to judge progress toward stated goals.

Step 11. Implement the Master Plan

Some of the important aspects of implementing the master plan are: (1) organizing the necessary personnel and resources into a well-formed field organization that will actually do the on-site development of the recreation area, (2) engaging the necessary political powers and financial resources to support the plan, and (3) appraising the field organization in terms of its actions and the consequences of its actions to meet planning goals.

Field work on implementing the master plan sometimes uncovers problems that were not recognized or anticipated in step 10. Some of these problems may have been overlooked in step 10, others may arise because of changes in the techniques for on-site development between the time the master plan was prepared and the time it is actually implemented, and still other problems may arise because of inaccurate estimates of the costs and benefits of development.

If such problems are minor, appropriate adjustments can be made in the master plan. If problems of implementation require major changes in the design of the master plan, retracing the planning process from step 9 may be necessary. Step 11, however, should not necessarily have to be

regenerated beginning with steps 1 to 8 if those steps were adequately performed.

Step 12. Replanning

Replanning is the step that makes the whole planning process continuous and dynamic. In a society where the growth and distribution of the population are changing, where values are changing, where the natural environment is changing, and where the whole social structure of society is changing, continuous research on and evaluation of planning is needed. Replanning, then, is a post-construction step that essentially provides for the retracing of any or all steps in the planning process.

THE PLANNING PROCESS AS A CIRCLE OF INTERDEPENDENCE[16]

The steps in the planning process are interdependent. That is, the planning process is a circle of interdependence incorporating both feedback and feedforward between the steps.

Feedback enables the planner to correct for future action in light of past experience. Feedback is inherent in all steps where actions are reviewed, amended, or discarded and can stem from the planner himself, from the local community, and from political decision-makers.

The dashed arrows in figure 1 show some, but not all, of these feedback mechanisms. The sequence of steps (the feedforward mechanism) in the planning process presented in this paper lends itself to feedback adjustments. Some feedback mechanisms were discussed in the planning steps above. The following discussion will serve to further illustrate these mechanisms.

Goal-setting feedback is the mechanism that adjusts for new constraints (such as changes in financial support) that are external to the initial goal-setting step. Feedback stemming from changes in values and goals held by society can also influence the original goals of the plan. Feedback relating to goals also affects values, so in reality values and goals are jointly determined.

The process of collecting, processing, transmitting, and using data is circular in nature. Analysis of data back and forth between the past, present, and future helps to achieve a balance between stated goals and on-the-ground operating requirements.[17]

Time horizons in planning also are related in a circular fashion. Long-range goals for the master plan are partly derived from shorter-range component plans, and partly shape and direct them. An unforeseen problem or opportunity within a component plan may lead to a modification of the master plan.[18]

Plan revision between steps 9 and 11 and other revisions in the form of replanning (step 12) are other forms of feedback. But practical limits to regular revision, such as the limitations of time, money, or personnel, must be recognized.

Footnotes

1. Note that a single park may contain many individual resources such as lakes, mountains, and wooded areas.

2. Unless otherwise specified, "planning," "plan," and "planner" refer to public outdoor recreation development planning, plan, and planner, respectively.

3. The distinction between "methodology" and "methods" is made clear in: Abraham Kaplan. THE CONDUCT OF INQUIRY. Chandler Publishing Co., San Francisco, pp. 18-33.

4. For outlines and discussions of these steps, see: (1) Louis Hamill, THE PROCESS OF MAKING GOOD DECISIONS ABOUT THE USE OF THE ENVIRONMENT OF MAN, Nat. Resources J. 8(2):279-301, 1968; (2) Willard B. Hansen, METROPOLITAN PLANNING AND THE NEW COMPREHENSIVENESS, J. Amer. Inst. Planners 34(5):295-302, 1968; (3) Britton Harris, THE LIMITS OF SCIENCE AND HUMANISM IN PLANNING, J. Amer. Inst. Planners 33(5):324-335, 1967; and (4) G. Marion Hinckley, PLANNING—A FIRST STEP IN RECREATIONAL DEVELOPMENT, *in* COUNTY PARKS AND RECREATION . . . A BASIS FOR ACTION, Philip Warren, Jr. (ed.), Nat. Assoc. Counties, Washington, D. C., and Nat. Recreation Assoc., New York, 1964, pp. 117-118.

5. A community refers to the people living together in a given geographical area and includes the entire social and economic structure within which those people function. A community may be a local town, a county, a state, a geographical region, or even a nation. As used in this paper, a community refers to the community that affects or is affected by a given recreation development.

6. These purposes are adapted from: Melville C. Branch, PLANNING: ASPECTS AND APPLICATIONS, John Wiley & Sons, Inc., New York, 1966, p. 62.

7. The following list is derived largely from James Oakwood and Michael Chubb, PLANNING PUBLIC RECREATIONAL BOATING FACILITIES IN MICHIGAN. Mich. State Univ. Coll. Agr. and Nat. Resources Dep. Resource Develop. Tech. Rep. 1: 7-20; East Lansing, 1968.

8. General discussions especially applicable to step 4 can be found in the following selected references: (1) Paul Davidoff and Thomas A. Reiner, A CHOICE THEORY OF PLANNING, J. Amer. Inst. Planners 28(2):103-115, 1962; Harris, *op. cit.*; (3) Morris Hill, A GOALS-ACHIEVEMENT MATRIX FOR EVALUATING ALTERNATIVE PLANS, J. Amer. Inst. Planners 34(1):19-28, 1968; and (4) Robert C. Young, GOALS AND GOAL-SETTING, J. Amer. Inst. Planners 32(2):76-85, 1966.

Selected references relating specifically to values and goals of recreation and other natural resource developments are: (1) Ronald Beazley, CONSERVATION DECISION-MAKING: A RATIONALIZATION, Nat Resources J. 7(3):345-360, 1967; (2) S. V. Ciriacy-Wantrup, THE ECONOMICS OF ENVIRONMENTAL POLICY, Land Econ. 47(1):36-45, 1971; (3) William A. Duerr, GOALS AND VALUES, a chapter in a forthcoming book on forest resource management; (4) George R. Hall, STRATEGY AND ORGANIZATION IN PUBLIC LAND POLICY, Nat. Resources J. 7(2):162-182, 1967; (5) Roger Tippy, PRESERVATION VALUES IN RIVER BASIN PLANNING, Nat. Resources J. 8(2):259-278, 1968; and (6) R. S. Whaley, MULTIPLE USE DECISION MAKING—WHERE DO WE GO FROM HERE?, Nat. Resources J. 10(3):557-565, 1970.

9. For a discussion on requisites, see Hill, *op. cit.*, especially p. 22.

10. A proposal is actually a plan that has at this step in the planning process not been accepted or rejected by the planner or the community as *the* course of action to pursue in developing a recreation complex.

11. A "no-action" alternative implies that no action is taken to solve the apparent problem because the statement of the problem in step 5 indicates that no problem really exists or because no proposal can satisfy the goals set out in step 4.

12. See the discussions and literature cited in the following selected references: (1) Marion Clawson and Jack L. Knetsch, ECONOMICS OF OUTDOOR RECREATION, Chaps. 11—"The Value of Land and Water Resources Used for Recreation," 12—"Economic Impact of Outdoor Recreation in Local Areas," and 13—"Cost and Investment Considerations in Providing Public Recreation Facilities" published for Resources for the Future, Inc., by The Johns Hopkins Press, Baltimore, 1966; (2) Robert J. Kalter and Lois E. Gosse, OUTDOOR RECREATION IN NEW YORK STATE: PROJECTIONS OF DEMAND, ECONOMIC VALUE, AND PRICING EFFECTS FOR THE PERIOD 1970-1985, Chap. V—"Demand Projections, Economic Value, and Pricing Effects," N. Y. State Coll. Agr. at Cornell Univ., Ithaca, 1970; (3) Leonard Merewitz, ESTIMATION OF RECREATIONAL BENEFITS AT SOME SELECTED WATER DEVELOPMENT SITES IN CALIFORNIA, U.S. Dep. Interior Tech. Rep. Washington, D. C., no date; and (4) A. R. Prest and R. Turvey, COST-BENEFIT ANALYSIS: A SURVEY, Econ. J. 75(3):683-735, 1965. This article surveys cost-benefit analysis techniques in general and includes references on outdoor recreation and other natural resource developments.

13. For a discussion of the public welfare aspects (including the distribution of income) related to outdoor recreation, see: G. A. Norton, PUBLIC OUTDOOR RECREATION AND RESOURCES ALLOCATION: A WELFARE APPROACH, Land Econ. 46(4): 413-422, 1970.

14. See: Hill, *op. cit.* pp. 20-21.

15. The "goals-achievement" approach discussed below is adapted from Hill, *op. cit.* pp. 21-28.

16. For a discussion of the planning process as a circle of interdependence, see Branch, *op. cit.* pp. 303-309.

17. Adapted from Branch, *op. cit.* p. 305.

18. Adapted from Branch, *op. cit.* p. 305.

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